



⑫ **EUROPEAN PATENT APPLICATION**

⑳ Application number : **91810428.2**

㉔ Date of filing : **05.06.91**

㉕ Int. Cl.⁶ : **C07D 405/04, C07D 405/14,
C07D 413/10, C07D 239/52,
C07D 403/06, C07D 409/06,
C07D 401/06, C07D 491/04,
C07D 413/06, A01N 43/54**

㉖ Priority : **07.06.90 US 534794
21.12.90 US 633592**

㉚ Date of publication of application :
11.12.91 Bulletin 91/50

㉛ Designated Contracting States :
AT BE CH DE DK ES FR GB GR IT LI LU NL SE

㉞ Applicant : **SANDOZ LTD.**
Lichtstrasse 35
CH-4002 Basel (CH)
㉛ **BE CH DK ES FR GB GR IT LI LU NL SE**

㉞ Applicant : **SANDOZ-PATENT-GMBH**
Humboldtstrasse 3
W-7850 Lörrach (DE)
㉛ **DE**

㉞ Applicant : **SANDOZ-ERFINDUNGEN**
Verwaltungsgesellschaft m.b.H.
Brunner Strasse 59
A-1235 Wien (AT)
㉛ **AT**

㉞ Inventor : **Anderson, Richard James**
3367 Kenneth Drive
Palo Alto, CA 94303 (US)
Inventor : **Cloudsdale, Ian Stuart**
730 Rebecca Drive
Boulder Creek, CA 95006 (US)
Inventor : **Hokama, Takeo**
715 Quetta Avenue
Sunnyvale, CA 94087 (US)

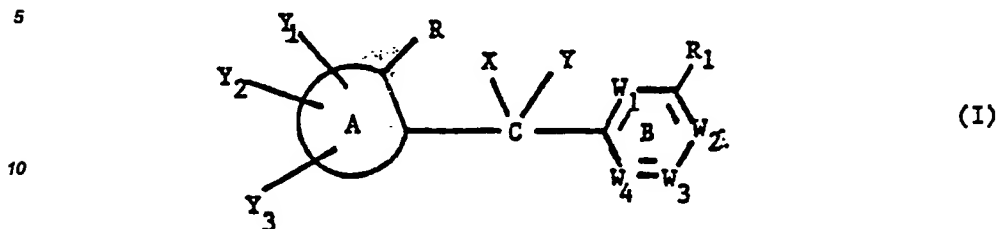
㉞ **Substituted phthalides and heterocyclic phthalides.**

㉞ **Substituted phthalides and heterocyclic phthalides and derivatives thereof which are useful as herbicides.**

EP 0 461 079 A2

The present invention concerns substituted phthalides and heterocyclic phthalides and derivatives thereof, processes for their production, compositions containing them and their use in agriculture.

More particularly, the invention concerns compounds of formula I



wherein ring system A is selected from

- 15 a) phenyl or naphthyl
 b) pyridyl which may be fused by its (b) or (c) side to benzene
 c) pyridyl-N-oxide or pyrazinyl-N-oxide
 d) pyrimidinyl
 e) pyrazinyl
 20 f) 3- or 4- cinnolynyl or 2-quinoxalynyl, and
 g) a five membered heteroaromatic ring comprising oxygen, sulphur or nitrogen as heteroatom(s) which ring may be fused to a benzene ring or may comprise nitrogen as an additional heteroatom.

R is cyano, formyl, $CX_1X_2X_3$, a ketone forming group, a carboxyl group which may be in the form of the free acid or in ester or salt form, a thiocarboxyl group which may be in the form of the free acid or in ester form, 25 a carbamoyl group or a mono- or di- substituted carbamoyl group, hydroxyalkyl, hydroxybenzyl, $-CH=NOH$, $-CH=NO$ -lower alkyl, the group $-CH_2-O-C(O)-$ and bridges adjacent carbon atoms in ring A, or a ring C



35 Y_1 , Y_2 and Y_3 are attached to carbon atoms and are independently hydrogen, halogen, hydroxy, alkyl, alkenyl, alkynyl, alkoxy, alkenyloxy, alkynyloxy, alkylsulfonyloxy, dialkylsulfamoyloxy, alkylsulfonyl, alkylsulfinyl, dialkylcarbamoyloxy, alkylthio, alkenylthio or alkynylthio each of which may in turn be substituted by 1 to 6 halogen atoms; dialkoxymethyl, conjugated alkoxy, hydroxyalkyl, carboxyl, acyl, acylalkyl, acyloxy, acyloxyalkyl, trialkylsilyloxy, trialkylsilyl, cyano, nitro, amino or substituted amino, aminosulfonyl; cycloalkyl, aryl, aralkyl, aralkenyl, aralkynyl, aryloxy, aralkoxy, arylsulfonyl, arylsulfinyl, arylthio or aralkylthio, each of which may be substituted by one to three substituents selected from halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, nitro, cyano, 40 alkylthio, acyl, amino or substituted amino; a group



wherein R' is hydrogen, lower alkyl, or lower alkoxy;

or Y_1 and R taken together on adjacent carbon atoms form a bridge having the formula



55 wherein E is a direct bond or a 1 to 3 membered linking group with elements selected from methylene, substituted methylene,



5 and oxygen.
or Y_1 and Y_2 taken together on adjacent carbon atoms form a 3- to 5-membered bridge comprised of elements selected from methylene, substituted methylene,

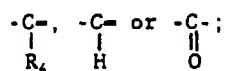


oxygen, and

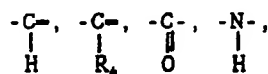


each of W_1 , W_2 , W_3 , W_4 and W_5 is independently CH, CR_3 or nitrogen; W_6 is NH, oxygen, sulfur,

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25 Z is a 2- or 3-membered bridge comprised of elements selected from methylene, substituted methylene,



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-N=, oxygen and



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R_1 and R_3 each is independently hydrogen; halogen; alkyl, alkenyl, alkynyl, alkoxy, alkenyloxy, alkynyloxy, alkylthio, alkenylthio or alkynylthio, each of which may in turn be substituted by 1 to 6 halogen atoms; cycloalkyl, heterocycloalkoxy, aryloxy, aralkoxy or aralkylthio each of which may be substituted by 1 to 3 substituents selected from halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, nitro, cyano, alkylthio, acyl, amino or substituted amino; aminoxy; substituted aminoxy; iminoxy; substituted iminoxy; amino; substituted amino; amido; substituted amido; alkylsulfonyl methyl; cyano; nitro; or

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wherein Y_4 is hydrogen, lower alkyl, lower alkoxy, hydroxy or unsubstituted or substituted phenyl.

R_4 is as defined for Y_1 except for hydrogen.

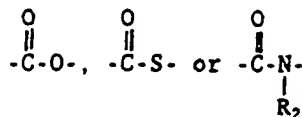
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X and Y each is independently hydrogen, hydroxy, halogen, cyano, alkyl, alkoxy, alkoxycarbonyl, alkoxycarbonyloxy, hydroxyalkyl, haloalkyl, acyl, acyloxy, carbamoyl, carbamolyoxy, alkylthio, alkylsulfinyl, alkylsulfonyl or alkylsulfonyloxy; aryl, aryloxy, arylS(O)_p, aralkyl, aralkoxy, aralkS(O)_p, arylsulphonyloxy, each of which may in turn be substituted by 1 to 3 substituents selected from halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, nitro, cyano, alkylthio, acyl; amino, substituted amino or together represent =O, =S, =NH, =NOR₁₂, or

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=CR₁₃R₁₄; or

X and R together may form a bridge having the formula



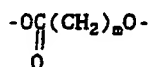
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wherein the carbonyl is attached to A and R_2 represents hydrogen, alkyl, haloalkyl, alkoxyalkyl, alkoxy, aralkoxy, unsubstituted or substituted aryl, unsubstituted or substituted aralkyl.

P is 0, 1 or 2.

10 X_1 , X_2 and X_3 are independently hydrogen, hydroxy, alkoxy, alkylthio, hydroxyalkyl or hydroxybenzyl whereby at least one of X_1 , X_2 and X_3 is other than hydrogen; or X_3 represents hydrogen and X_1 and X_2 together form a four or five membered bridge comprising elements selected from $-\text{O}(\text{CH}_2)_n\text{O}-$.

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and $-\text{S}(\text{CH}_2)_n\text{S}-$.

R_{12} is hydrogen or alkyl,

20 R_{13} and R_{14} are independently hydrogen, alkyl or halogen,

m is one or two,

n' is two or three

with the proviso that when R is carboxyl in free ester or salt form and X and Y together are =O one of rings A and B contains a hetero atom.

25 When R is a ketone forming group this is preferably



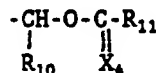
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wherein R'' is alkyl, haloalkyl, alkoxyalkyl, alkenyl, alkynyl, unsubstituted or substituted aryl, unsubstituted or substituted aralkyl.

When R is a carboxyl or thiocarboxyl group in ester form it is preferably of formula $-\text{COOR}_5$ or $-\text{COSR}_5$ wherein R_5 is alkyl, haloalkyl, alkoxyalkyl, alkenyl, haloalkenyl, alkynyl, haloalkynyl, unsubstituted or substituted aryl, unsubstituted or substituted aralkyl, hydroxyalkyl, cycloalkyl, cyanoalkyl, aralkoxyalkyl; a group $-\text{N}=\text{C}(\text{R}_{15})(\text{R}_{16})$; a group $-(\text{CH}_2)_n\text{CH}(\text{R}_{17})(\text{R}_{18})$; a group

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R_{15} and R_{16} are independently hydrogen or alkyl,

45 R_{17} and R_{18} are independently $\text{S}(\text{O})_p$ alkyl, COOR_6 , alkoxy, amino, substituted amino, benzyloxy, trimethylsilyl, cyano, $-\text{C}(\text{R}_{19})\text{SR}_{20}$ or additionally one thereof may be hydrogen.

R_{19} is hydrogen or alkyl,

R_{20} is alkyl or aryl,

50 R_9 , R_{10} and R_{11} are independently hydrogen, alkyl, haloalkyl, alkoxyalkyl, unsubstituted or substituted aryl or unsubstituted or substituted aralkyl,

n and n'' are independently zero, one or two, and

X_4 is oxygen or sulfur.

When R is a carbamoyl group or a mono- or di-substituted carbamoyl group it is preferably of formula CONR_7R_8 wherein R_7 and R_8 are independently hydrogen or an aliphatic or a saturated or unsaturated cyclic or heterocyclic group each of which may be unsubstituted or substituted.

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R_7 and R_8 are preferably each independently (a) hydrogen, halogen; (b) alkyl, alkenyl, alkynyl alkoxy, alkoxyalkoxy, alkenyloxy, alkynyloxy, alkyl $\text{S}(\text{O})_p$, alkenyl $\text{S}(\text{O})_p$ or alkynyl $\text{S}(\text{O})_p$, alkyl $\text{S}(\text{O})_p$ alkyl, alkenyl $\text{S}(\text{O})_p$ alkyl, alkynyl $\text{S}(\text{O})_p$ alkyl, each of which may in turn be substituted by 1 to 6 halogen atoms and each

of which may be attached to the adjacent nitrogen atom via alkyl; (c) acyl, acylalkyl, acyloxy, acyloxyalkyl; (d) cycloalkyl, cycloalkylalkyl, heterocyclyl, heterocycloalkyl, heterocycloalkoxy, aryl, aralkyl, aryloxy, aralkoxy, arylS(O)_p, aralkylS(O)_p or arylS(O)_palkyl, each of which is unsubstituted or may be substituted by 1 to 3 substituents selected from (i) halogen; (ii) alkyl, alkenyl, alkynyl, alkoxy, alkoxyalkoxy, alkenyloxy, alkynyloxy, alkylS(b)_p, alkenylS(O)_p, or alkynylS(O)_p, alkylS(O)_palkyl, alkenylS(O)_palkyl or alkynylS(O)_palkyl, each of which may in turn be substituted by 1 to 6 halogen atoms; and (iii) nitro, cyano, acyl, amino, substituted amino, aminosulfonyl, aminoalkyl or substituted aminoalkyl; (e) amino, substituted amino, amido, substituted amido, aminosulfonyl, cyano, nitro, or -(CHR₄')_{n''}-C(O)Y₄',

wherein Y₄' is hydrogen, lower alkyl, lower alkoxy or hydroxy and n'' is 0, 1, 2 or 3 and p is 0, 1 or 2.

R₄' is as defined for Y₁.

When R is carboxyl in salt form the salt is preferably formed with an alkali metal, alkali earth metal, optionally substituted ammonium cation, a trialkyl sulfonium cation, a trialkylsulfoxonium cation or a phosphonium cation, especially the cation of an alkali metal (e.g. the Li or Na cation) or of an earth alkali metal (e.g. the Ca or Mg cation); the ammonium cation; a substituted ammonium cation [such as a C₁₋₆alkylammonium cation, a di-C₁₋₆alkylammonium cation, a tri-C₁₋₆alkyl-ammonium cation, a tetra-C₁₋₆ammonium cation, a (C₁₋₆alkoxy-alkyl)ammonium cation, a (hydroxy-C₁₋₆alkyl)ammonium cation]; a phosphonium cation; a tri(C₁₋₆alkyl)sulfonium cation; or a tri(C₁₋₆alkyl)sulfoxonium cation.

When Y₁, Y₂ and/or Y₃ is a carboxyl group this may be in ester or salt form or in amide form (i.e. a carbamoyl) and as such is as described above for R in these forms. Where A has meaning g) it contains one to three heteroatoms and signifies for example thienyl, furanyl, pyrrolyl, oxazolyl, thiazolyl, isoxazolyl, isothiazolyl, imidazolyl, pyrazolyl, oxadiazolyl or thiadiazolyl.

Where A has one of the above defined heteroaromatic significances, b) through g), the substituted hetero ring is particularly selected from pyridyl, quinolyl, pyridyl-N-oxide, pyrimidinyl, pyrazinyl, thienyl or furyl, more particularly from pyridyl or thienyl.

Alkyl moieties unless otherwise specified contain 1 to 8 carbon atoms, preferably 1 to 5, especially 1 to 4, e.g. 1 or 2 carbon atoms. Lower alkyl moieties contain 1 to 4, e.g. 1 or 2 carbon atoms. Alkyl moieties as or present in R₆, R₇ or R₈ contain 1 to 24 preferably 1 to 12, especially 1 to 6 whereby one of R₇ and R₈ is preferably hydrogen when the other is alkyl.

Alkyl moieties as bridging groups may be straight chain or branched and preferably contain 1 to 4, e.g. 1 or 2 carbon atoms. They may be optionally substituted by aryl or substituted aryl and may optionally be interrupted by or attached via an oxygen or sulfur atom.

"Conjugated alkoxy" stands for an alkoxy group interrupted in its alkyl moiety by one or more oxygen atoms eg alkoxyalkoxy, alkoxyalkoxyalkoxy, etc.

Alkenyl and alkynyl moieties contain 2 to 8, preferably 2 to 4, especially 2 or 3 carbon atoms.

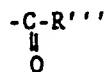
Halogen is preferably F, Cl or Br, especially for Cl.

Aryl moieties are preferably as defined for meanings a) to g) of ring system A or as ring B and preferred meanings of each, especially phenyl. Such aryl moieties may be unsubstituted or substituted and in the latter case carry 1 to 3 substituents as defined for Y₁ unless otherwise specified.

Substituted amino, -amido, -aminoxy, -aminoalkyl, -iminoxy, -carbamyl (other than as R) is preferably substituted by one or two substituents selected from alkylalkoxy, haloalkyl, acyl, alkoxyalkyl, unsubstituted or substituted aryl or unsubstituted or substituted aralkyl.

Substituted methylene is preferably substituted by one or two groups as defined for Y₁.

Acyl as or as part of a substituent is conveniently



wherein R''' is as defined for Y₁ (for example alkyl, haloalkyl, cycloalkyl, alkoxyalkyl, unsubstituted or substituted aryl (especially phenyl). Examples of acyl include acetyl, propionyl, butyryl, unsubstituted or substituted benzoyl, pivaloyl or chloroacetyl, especially acetyl or unsubstituted or substituted benzoyl.

Cycloalkyl is preferably of 3 to 6 carbon atoms especially cyclopropyl, cyclopentyl or cyclohexyl, heterocyclo is preferably 5 or 6 membered and as defined for A definitions b) to g) and preferences or saturated and containing O, S or N as heteroatom, eg tetrahydrofuryl, piperidinyl, morpholinyl.

For convenience bridging members such as



are so written but are to be understood as embracing



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Carbamoyl or substituted carbamoyl moieties are attached to the molecule which they substitute via their carbonyl. Amido or substituted amido moieties are attached to the molecule which they substitute via their nitrogen atom.

A particular group of compounds of formula I (compounds Ia) comprises those wherein ring system A is selected from phenyl, pyridyl or pyridyl-N-oxide.

R is a carboxyl group which may be in the form of the free acid or in ester or salt form, a thiocarboxyl group which may be in the form of the free acid or in ester form, a carbamoyl group or a mono- or di-substituted carbamoyl group.

Y₁, Y₂ and Y₃ are attached to carbon atoms and are independently hydrogen, halogen, alkyl, alkoxy; each of W₁, W₂, W₃, W₄ and W₅ is independently CH, CR₃ or nitrogen;

W₆ is NH or oxygen;

Z is a 2- or 3-membered bridge comprised of elements selected from methylene, substituted methylene or

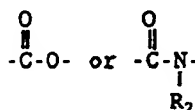
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R₁ and R₃ each is independently hydrogen, halogen, alkyl, alkoxy, aryloxy or aralkoxy.

X and Y each is independently hydrogen, hydroxy, cyano, alkoxy, acyloxy or together represent =O; or X and R together form a bridge having the formula

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wherein the carbonyl is attached to A.

When R is carboxyl or thiocarboxyl in ester form it is preferably of formula -COOR₆ or COSR₆;

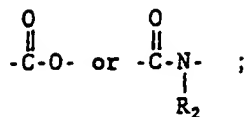
wherein each R₆ is independently alkyl, alkoxyalkyl, alkenyl, alkynyl, substituted aryl or unsubstituted or substituted aralkyl.

When R is carboxy or thiocarboxyl in salt form the salt is preferably formed with an alkali metal, alkali earth metal, optionally substituted ammonium cation especially the cation of an alkali metal (e.g. the Li or Na cation) or of an earth alkali metal (e.g. the Ca or Mg cation); the ammonium cation; a substituted ammonium cation (such as a C₁₋₆alkylammonium cation, a di-C₁₋₆alkylammonium cation, a tri-C₁₋₆alkylammonium cation, a tetra-C₁₋₆alkylammonium cation).

When R is carbamoyl or mono- or di-substituted carbamoyl it is preferably of formula CONR₇R₈ wherein R₇ is hydrogen, alkyl, haloalkyl, alkoxyalkyl, unsubstituted or substituted aryl or unsubstituted or substituted aralkyl and R₈ is hydrogen, alkyl, NH₂, NHR₆ or OR₆ wherein R₆ is as defined for R₇.

A particular compound group (compounds Ib) comprises those compounds of formula I wherein ring system A represents phenyl, pyridyl or thienyl; B represents pyrimidinyl or triazinyl; R represents a ring C especially oxazole, oxazolone, oxazolidine or oxazolidinone; carboxyl in the form of the free acid or in ester or salt form; substituted carbamoyl, cyano or together with X represent

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5

Y_1 , Y_2 and Y_3 each represent independently hydrogen, halogen, alkyl, alkoxy, alkylthio or arylthio.

X , Y each represent independently hydrogen, hydroxy, alkoxy, acyloxy, a ring B, halogen, alkylthio or arylthio or together $=\text{O}$ or $=\text{NH}$

10 and R_1 and R_3 each represent independently halogen, alkoxy, alkyl, haloalkoxy, optionally substituted aryloxy, aralkoxy, alkynyloxy, alkenyloxy.

A further compound group comprises compounds Ib wherein Y_1 , Y_2 and Y_3 additionally may each represent independently aralkoxy, alkenyloxy or alkynyloxy.

B is especially pyrimidinyl, particularly 4,6-dimethoxy-2-pyrimidinyl.

15 A is especially phenyl or pyridyl substituted as defined above.

X and Y are preferably hydrogen, halogen, cyano, hydroxy, alkoxy or together $-\text{O}$, especially hydrogen, hydroxy or together $=\text{O}$.

A further group of compounds according to the invention (Compounds Ic) comprises those of formula I wherein ring system A is pyridyl,

20 R is CONR_7R_8

wherein R_7 and R_8 represent independently hydrogen, alkoxy, alkyl; or aryl or aralkyl each of which may be unsubstituted or substituted,

X is hydrogen,

Y is OR_3 , SR_3 or OCOR_3

25 wherein R_3 is alkyl; or aryl; or aralkyl each of which may be unsubstituted or substituted,

or X and Y together represent $-\text{O}$ or $=\text{S}$ and ring system B is $m\text{-CF}_3$ phenyl.

Within this group Ic, compounds are preferred wherein X is OH and Y is H or X and Y together represent $=\text{O}$, A is 2- or 3-pyridyl, R_7 is hydrogen or alkyl especially methyl, R_8 is phenyl or benzoyl which may be unsubstituted or substituted eg 1-3 times by halogen, alkyl and/or alkoxy. The following meanings are preferred independently for each substituent.

30 A

a) meanings a) and b)

b) phenyl

c) pyridyl

R a) carboxyl in the form of the free acid or in salt or ester form or carbamoyl or mono- or di-substituted carbamoyl

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b) COOR_5 wherein R_5 is hydrogen alkyl, COO^+Ma^- wherein Ma is an alkali metal cation or CONR_7R_8 wherein R_7 is hydrogen or alkyl and R_8 is alkyl, aryl or substituted aryl

c) COO^-Na^+ , COOCH_3 , $\text{CONHC}_6\text{H}_{13}$, $\text{CONH}(\text{CH}_3)$ phenyl

Y_1

a) hydrogen, halogen, alkyl or alkoxy

40

b) halogen, especially fluorine or chlorine

Y_2 , Y_3

a) hydrogen or halogen, alkyl or alkoxy

b) hydrogen or halogen

c) hydrogen

W_1

N

45

W_2

a) CH or N

b) CH

W_3

CR_3

W_4

N

W_5

a) CH or N

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b) N

W_6

a) O

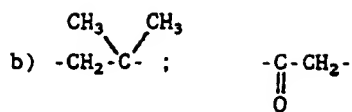
b) NH

Z

a) elements selected from methylene, substituted methylene,

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	X_1, X_2	a) alkoxy, especially methoxy b) hydroxy
	X_3	a) hydrogen
10	R_1, R_3	b) alkoxy especially methoxy a) alkoxy, especially methoxy
	R_4	a) halogen, especially chlorine b) alkyl, especially methyl
	R_2	a) alkyl, especially methyl b) hydrogen
15	R_5	a) alkyl, alkenyl or alkynyl b) C_{1-4} alkyl, especially methyl or ethyl c) C_{2-4} alkenyl d) C_{2-4} alkynyl, especially propargyl
20	R_6, R_7	a) alkyl b) methyl, ethyl
	R_8	a) hydrogen b) alkyl, especially methyl or ethyl c) an aryl, especially a phenyl
25	$R_9, R_{10},$ R_{12}, R_{15}, R_{19}	a) hydrogen or alkyl b) hydrogen or methyl
	R_{11}	a) alkyl b) propyl (n- or iso-)
30	Y_4	a) alkyl or alkoxy b) CH_3 or CH_3O
	R_{13}, R_{14}	a) hydrogen or halogen b) hydrogen or fluorine
	R_{16}	a) alkyl b) C_{1-4} alkyl, especially methyl or ethyl
35	R_{17}	a) $\text{S}(\text{O})_n\text{alkyl}$ or COOR_9 b) SO_2CH_3 or COOCH_3
	R_{18}	a) hydrogen
	R_{20}	a) alkyl or phenyl b) methyl or phenyl
40	n	a) 2 b) 0
	n'	a) 2 b) 3
45	n''	a) 1 b) 0
	m	a) 1 b) 2
	X	a) hydroxyl b) hydrogen
50		c) taken with Y, =O d) acyloxy e) alkoxy-carbonyloxy f) carbamoyloxy g) sulphonyloxy
55	Y	a) taken with X, =O b) hydrogen



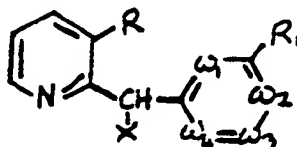
- 5 R' a) alkyl
 b) alkoxy
 R'' a) alkyl
 b) methyl
 R''' a) alkyl
10 b) aryl, especially phenyl
 Ring A, Ring B a) at least one contains a heteroatom
 b) ring A = a phenyl or a pyridine
 ring B = a pyrimidine especially 3,5 dimethoxy pyrimidine

Combinations of the above listed preferred meanings are especially preferred. One such combination comprises compounds of formula (I) in which

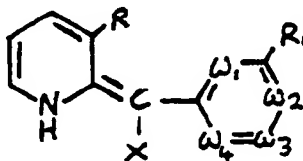
- 15 A is phenyl or pyridyl;
 R is a carboxyl group in the form of a free acid or salt; carbamoyl; COOR₅" wherein R₅" is C₁₋₆alkyl or C₂₋₆alkenyl or CONR₇"R₈" wherein
 R₇" is C₁₋₁₂alkyl, amino, C₁₋₄alkylamino, anilino, haloanilino, benzyl, halobenzyl, C₁₋₄alkylbenzyl,
20 C₁₋₄alkoxybenzyl, phenyl, halophenyl, C₁₋₄alkylphenyl or C₁₋₄alkoxyphenyl;
 R₈" is hydrogen or C₁₋₄alkyl;
 Y₁, Y₂ and Y₃ are independently hydrogen or halogen;
 W₁ and W₄ are N;
 W₂ is CH;
25 W₃ is CR₃ wherein R₃ is C₁₋₆alkoxy;
 R₁ is C₁₋₆alkoxy;
 X is hydroxyl or C₁₋₄alkoxycarbonyloxy or taken with Y is =O;
 Y is hydrogen or taken with Y is =O; or
30 X and R together form a bridge having the formula -C(O)O- wherein the carbonyl is attached to A, and Y is hydrogen or C₂₋₆alkoxyloxy.

Examples of preferred compounds according to the invention are compound nos. 13, 40, 53, 55, 58, 64, 77, 78, 82, 91, 103, 111, 124, 125, 130, 143, 149, 163, 170, 175, 183, 199, 204, 205, 211, 219, 220, 224, 247, 249, 258, 262, 263, 265, 266, 267, 273 and 277.

35 Compounds having the formula

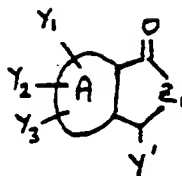


40 especially those wherein X is CN may exist in the alternate tautomeric form



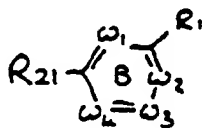
The compounds of formula I according to the invention may be prepared as follows.

- 55 a) when X and R combine to form a bridging group as defined above and Y is hydrogen, cyano, arylthio, arylsulfinyl or arylsulfonyl, reacting a compound of formula II



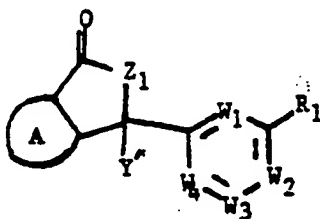
(II)

wherein A is as defined above, Y' represents hydrogen, cyano, arylthio, arylsulfinyl or arylsulfonyl and Z₁ represents oxygen, sulfur or NR₂ wherein R₂ is as defined above except for hydrogen. with a compound of formula III



(III)

wherein W₁, W₂, W₃, W₄ are as defined above and R₂₁ represents methylsulfonyl, or halogen to obtain the corresponding compound of formula Ip



(Ip)

b) treating a compound of formula Ip wherein Y' represents cyano or arylsulfonyl and Z₁ represents oxygen and the other symbols are as defined above.

(i) by hydrolysis to give a corresponding compound of formula I wherein R and X form a bridge and Y is hydroxy or a compound of formula I wherein X and Y together form =O

(ii) with an amine to give a corresponding compound of formula I wherein R is an optionally substituted carbamoyl group and X and Y together form =O

(iii) with a group



wherein M is an alkali metal and R₂₂ is hydrogen or alkyl, to give a corresponding compound wherein R and X form a bridge and Y is hydroxy or alkoxy

c) hydrolyzing a compound of formula Ip wherein Y' represents hydrogen and Z₁ represents oxygen to give a compound of formula I wherein R is a carboxyl group optionally in salt form, X is hydrogen and Y is hydroxy

d) ring opening a compound of formula Ip wherein Y' represents hydroxy and Z₁ represents oxygen to give a compound of formula I wherein R is a carboxyl group optionally in salt form and X and Y together are =O

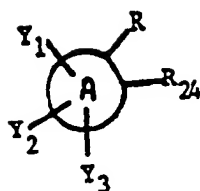
e) esterifying a compound of formula I wherein R is a carboxyl group optionally in salt form and X and Y are =O to give the corresponding compound wherein R is a carboxyl group in ester form

f) halogenating a compound of formula Ip wherein Y' represent hydroxy to give a compound of formula I wherein X and R together form a bridging group and Y' is halogen

g) reacting a compound of formula Ip wherein Z₁ is oxygen and Y' is halogen with a group R₂NH₂ and a group HOR₂₃ wherein R₂₃ represents alkyl, acyl or aryl and R₂ is as defined above to give the corresponding compound wherein Z₁ is NR₂ and Y' is alkoxy, aryloxy or acyloxy

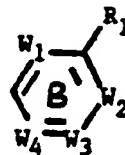
h) oxidizing a compound of formula Ip wherein Y' represents hydrogen to give the corresponding compound wherein Y' represents hydroxy

i) reacting a compound of formula IV

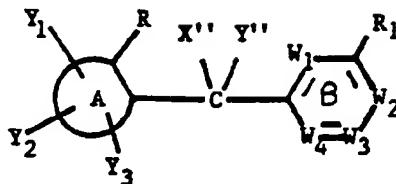


(IV)

with a compound of formula V



to produce a compound of formula Iq



(Iq)

where in A, R, R₁, W₁, W₂, W₃, W₄, Y₁, Y₂ and Y₃ are as defined above and X'' and Y'' are hydrogen and R₂₄ is alkyl, especially methyl

j) mono- or di-halogenating a compound of formula Iq wherein X'' and Y'' are hydrogen to produce the corresponding compound of formula Iq wherein one or both of X'' and Y'' are halogen

k) oxidizing a compound of formula Iq wherein X'' and Y'' are both hydrogen or X'' is halogen and Y'' is hydrogen to produce the corresponding compound wherein X'' and Y'' together represent =O or one represents hydrogen and the other represents hydroxy

l) alkylating a compound of formula Iq wherein X'' represents hydrogen and Y'' represents hydrogen to produce the corresponding compound wherein X'' represents alkyl and Y'' represents hydrogen

m) introducing an alkoxy or alkylthio group into a compound of formula Iq wherein X'' represents halogen and Y'' represents hydrogen to produce the corresponding compound wherein X'' represents alkoxy or alkylthio and Y'' represents hydrogen

n) acylating a compound of formula Iq wherein X'' represents hydroxy and Y'' represents hydrogen to produce the corresponding compound wherein X'' represents acyloxy and Y'' represents hydrogen

o) reacting a compound of formula Ip wherein Z₁ is oxygen and Y' is hydrogen with a group R₇NH₂ wherein R₇ is as defined above to give a compound of formula I wherein R is monosubstituted carbamoyl, X is hydrogen and Y is hydroxy

p) sulfonylating, carbamoylating, acylating or carbalkoxylating a compound of formula Ip wherein Z₁ is oxygen and Y' is hydroxy to produce the corresponding compound of formula I wherein R and X form a



bridge and Y represents sulfonyloxy, carbamoyloxy, acyloxy or alkoxycarbonoyloxy

q) reacting a compound of formula Ip wherein Z₁ is oxygen and Y' is halogen with a group R₇R₈NH wherein R₇ and R₈ are as defined above (R₇ and R₈ ≠ H) to give a compound of formula I wherein R is disubstituted carbamoyl, and X and Y together represent =O.

and recovering any compound wherein R is a carboxyl or thiocarboxyl group in free form or in ester form and any compound wherein R is carboxyl in free form or in salt form.

The following table is illustrative of suitable reaction conditions.

REACTION CONDITIONS

	Reaction Reagents	Solvents	Temperature	Others
5	a) 1) a) base eg LDA or b) base eg NaH 2) III	1) and 2) inert eg DMF, ether, cyclic ether eg THF -.	a) reduced eg -70° b) R.T.	
10	b) i) 1) base eg NaOH 2) acidify	inert eg ether, cyclic ether eg THF or alcohol eg methanol	R.T.	
	b) ii) 1) amine	inert eg ether, cyclic ether eg THF		
15	b) iii) MOR_{22}	alcohol eg methanol, cyclic ether eg THF		
20	c) base eg LiOH	water optionally with an alcohol or cyclic ether eg THF	R.T.	
	d) base eg NaOH	as c)	R.T.	
25	e) halide eg IR_3 base eg K_2CO_3 , NaH	inert eg DMF, 2-butanone (MEK)	elevated eg 50-80°	
	f) halogenating agent eg $SOCl_2$, DMF	inert eg chlorinated hydrocarbon eg CCl_4 , CH_2Cl_2	elevated eg 50-80°	
30	g) 1) R_1NH_{22} ; $R_{22}OH$	as f)	elevated eg 50-80°	
35	h) 1) oxidizing agent eg $NaOCl$ 2) base eg NaOH 3) acid eg HCl	1), 2) and 3) inert eg H_2O optionally with alcohol eg methanol	elevated eg 50° R.T. R.T.	
40	i) 1) base eg LDA 2) AcOH 3) DDQ 4) aq NaOH	1) anhyd. inert eg ether such as cyclic ether eg THF 2), 3) and 4) ether, H_2O	reduced eg -30° R.T. reduced eg 0° elevated eg 75°	
45	j) NBS, benzoylperoxide	inert eg halogenated hydrocarbon such as CCl_4	elevated eg 75°	
	k) DMSO, Na_2CO_3	DMSO	elevated eg 50-60°	
	l) base eg NaH, alkyl halide	inert eg ether, THF	0° → R.T.	
50	m) MOR_{22} , MSR_{22} eg $NaOCH_3$	inert eg DMF, alcohol	R.T. → 50°	

55

REACTION CONDITIONS (cont.)

Reaction	Reagents	Solvents	Temperature	Others
5		O		
10	n) acyl chloride eg CH_3CCl or anhydride eg Ac_2O ; amine eg triethylamine	inert eg ether, THF pyridine	R.T. \rightarrow 30°	
15	o) amine, eg α -methyl benzylamine or amine, eg aniline, $\text{CH}_3\text{SO}_2\text{NH}_2$; Me_3Al (catalyst)	alcohol eg methanol inert eg toluene CH_2Cl_2	R.T. \rightarrow 80° R.T.	
20	p) acylchloride eg acetyl- chloride, ethylchloro- formate or anyhdride; amine eg DMAP, triethylamine or isocyanate eg methylisocyanate; amine eg triethylamine or sulfonyl chloride eg methyl- sulfonyl chloride; amine eg triethylamine	inert eg ether THF, pyridine -.-	R.T. -.-	
25	q) $\text{R}_1\text{R}_2\text{NH}$, triethylamine, DMAP	inert eg CH_2Cl_2	-.-	

Process a) through p) also form part of the invention.

The starting materials of formula II or III are either known or may be prepared analogously to known methods.

The compounds of formula I have herbicidal activity as observed after their pre-emergent or post-emergent application to weeds or a weed locus.

The term "herbicide" (or "herbicidal") refers to an active ingredient (or an effect) which modifies the growth of plants because of plant growth regulating or phytotoxic properties so as to retard the growth of the plant or damage the plant sufficiently to kill it.

Application of a compound of formula I is made according to conventional procedure to the weeds or their locus using a herbicidally effective amount of the compound, usually from 10 g to 10 kg/ha.

Compounds according to the invention may be used in the control of both broad-leaf and grassy weeds on both pre- and post-emergent application. Compounds may also exhibit selectivity in various crops and are thus suited for use in weed control in crops such as corn, cotton, wheat and soybean.

The optimum usage of a compound of formula I is readily determined by one of ordinary skill in the art using routine testing such as greenhouse testing and small plot testing. It will depend on the compound employed, the desired effect (a phytotoxic effect requiring a higher rate than a plant growth regulating effect), the conditions of treatment and the like. In general satisfactory phytotoxic effects are obtained when the compound of formula I is applied at a rate in the range of from 0.01 to 5.0 kg, more preferably of from 0.05 to 2.5 kg per hectare, eg 0.05 to 5.0 kg per hectare, especially 0.1 to 2.5 kg per hectare.

The compounds of formula I may be advantageously combined with other herbicides for broadspectrum weed control. Examples of herbicides which can be combined with a compound of the present invention include those selected from the carbamates, thiocarbamates, chloroacetamides, dinitroanilines, benzoic acids, glycerol ethers, pyridazinones, semicarbazones, uracils and ureas for controlling a broad spectrum of weeds.

The compounds of formula I are conveniently employed as herbicidal compositions in association with agriculturally acceptable diluents. Such compositions also form part of the present invention. They may contain, aside from a compound of formula I as active agent, other active agents, such as herbicides or compounds

having antidotal, fungicidal, insecticidal or insect attractant activity. They may be employed in either solid or liquid forms eg in the form of a wettable powder or an emulsifiable concentrate incorporating conventional diluents. Such compositions may be produced in conventional manner, eg by mixing the active ingredient with a diluent and optionally other formulating ingredients such as surfactants.

5 Agriculturally acceptable additives may be employed in herbicidal compositions to improve the performance of the active ingredient and to reduce foaming, caking and corrosion, for example.

The term "diluent" as used herein means any liquid or solid agriculturally acceptable material which may be added to the active constituent to bring it in an easier or improved applicable form, respectively, to a usable or desirable strength of activity. It can for example be talc, kaolin, diatomaceous earth, xylene or water.

10 "Surfactant" as used herein means an agriculturally acceptable material which imparts emulsifiability, spreading, wetting, dispersibility or other surface-modifying properties. Examples of surfactants are sodium lignin sulfonate and lauryl sulfate.

Particularly formulations to be applied in spraying forms such as water dispersible concentrates or wettable powders may contain surfactants such as wetting and dispersing agents, for example the condensation product of formaldehyde with naphthylene sulphonate, an ethoxylated alkylphenol and an ethoxylated fatty alcohol.

15 In general, the formulations include from 0.01 to 90% by weight of active agent and from 0 to 20% by weight of agriculturally acceptable surfactant, the active agent consisting either of at least one compound of formula I or mixtures thereof with other active agents. Concentrate forms of compositions generally contain between about 2 and 90%, preferably between about 5 and 70% by weight of active agent. Application forms of formulation may for example contain from 0.01 to 20% by weight of active agent.

20 Typical herbicidal compositions, according to this invention, are illustrated by the following Examples A, B and C in which the quantities are in parts by weight.

EXAMPLE A

25

Preparation of a Dust

10 Parts of a compound according to this invention and 90 parts of powdered talc are mixed in a mechanical grinder-blender and are ground until a homogeneous, free-flowing dust of the desired particle size is obtained.

30 This dust is suitable for direct application to the site of the weed infestation.

EXAMPLE B

Preparation of a Wettable Powder

35

25 Parts of a compound according to this invention are mixed and milled with 25 parts of synthetic fine silica, 2 parts of sodium lauryl sulphate, 3 parts of sodium ligninsulphonate and 45 parts of finely divided kaolin until the mean particle size is about 5 micron. The resulting wettable powder is diluted with water before use to a spray liquor with the desired concentration.

40

EXAMPLE C

Preparation of Emulsifiable Concentrate (EC)

45 13.37 Parts of a compound according to this invention are mixed in a beaker with 1.43 parts of Toximul 360A (a mixture of anionic and nonionic surfactants containing largely anionic surfactants), 5.61 parts of Toximul 360A (a mixture of anionic and non-ionic surfactants containing largely non-ionic surfactants), 23.79 parts of dimethylformamide and 55.8 parts of Tenneco 500-100 (predominantly a mixture of alkylated aromatics such as xylene and ethylbenzene) until solution is effected. The resulting EC is diluted with water for use.

50 The following examples are provided to illustrate the practice of the present invention. Temperature is given in degrees Celsius.

Abbreviations used in this specification.

THF = tetrahydrofuran

LDA = lithiumdiisopropylamide

55 RT = room temperature

DMF = dimethylformamide

DDQ = 2,3-dichloro-5,6-dicyanobenzoquinone

NBS = N-bromosuccinimide

DMSO = Dimethylsulfoxide

MEK = Methyl ethyl ketone

DMAP = Dimethylaminopyridine

Individual alkyl substituents listed in the following tables from A to F are in the "n" isomeric form unless otherwise indicated.

EXAMPLE 1

7-chloro-3-(4,6-dimethoxy-2-pyrimidinyl)phthalide (Table A, cpd. no. 6)

10

1.68 g (0.01 mol) of 7-chlorophthalide is added to 100 ml of dry THF and the mixture cooled to -70°C. 6.8 ml (0.01 mol) of 1.5 M LDA is then added over 3 minutes and the reaction mixture stirred at -70°C for 15 minutes. 2.18 g (0.01 mol) of 2-methylsulfonyl-4,6-dimethoxypyrimidine in 50 ml of THF is then added and the mixture stirred for 4 hrs with temperature being maintained at -75 to -70°C. The reaction mixture is neutralized with 1.5 g of NH₄Cl in 5 ml of water, warmed and concentrated on a rotovaporator. The concentrate is partitioned between CH₂Cl₂/H₂O (50 ml each) and the aqueous phase separated and treated with further 30 ml of CH₂Cl₂. The combined CH₂Cl₂ phases are washed with 30 ml of water, separated and concentrated. The concentrate was flash chromatographed on silica gel using 80/20 hexane/ethyl acetate (500 ml), 50/50 hexane/ethyl acetate (500 ml) and 80/20 acetone/methanol (500 ml) (30 fractions X 50 ml). The title compound (fractions 9-23) was obtained after recrystallization from hexane/CH₂Cl₂ as a white solid, m.p. 148-149°C.

20

EXAMPLE 2

5-(4,6-dimethoxy-2-pyrimidinyl)-furo[3,4,b] pyridine-7(5H)-one (Table B, cpd. no. 40)

25

A solution of 1.3 g (0.0096 mols) of furo[3,4-b]pyridine-7(5H)-one in 50 ml of dry THF is cooled to -75° C and 8 ml (0.0192 mols) of 2.5 M LDA added dropwise over 5 minutes. The mixture is allowed to react for 1 hr at -75° C and 2.1 g (0.0096 mol) of 2-methylsulfonyl-4,6-dimethoxypyrimidine in 30 ml of dry THF added dropwise over 10 minutes. The mixture is allowed to warm to RT, 1.6 ml of HCl added and the THF evaporated off. The residue is dissolved in 75 ml of CH₂Cl₂, washed with water (2 x 50 ml) and the organic phase concentrated to give a yellowish white gummy solid. This is chromatographed on a silica gel column using 50/50 hexane/ethylacetate (500 ml), ethyl acetate (500 ml) and 80/20 acetone/methanol (1000 ml) (30 fractions). The crystalline residue (fractions 18-21) of the title product has m.p. of 167-168°C.

30

EXAMPLE 3

7-chloro-3-methoxy-3-(4,6-dimethoxy-2-pyrimidinyl)-2-methylisoindol-1(3H)-one (Table C, cpd. no. 54)

A mixture of 0.5 g of 7-chloro-3-hydroxy-3-(4,6-dimethoxy-2-pyrimidinyl)phthalide, 30 ml of CCl₄, 2 ml of SOCl₂ and 4 drops of DMF is heated at 65°C for 1½ hrs, cooled and excess SOCl₂ and CCl₄ removed on a rotovaporator. The residue is diluted with 20 ml of CH₂Cl₂ and added to a mixture of 5 ml of 40% aq methylamine and 10 ml of methanol with stirring over ½ hr. The mixture is placed on a rotovaporator and the residue partitioned between 50 ml each of CH₂Cl₂ and water. The organic phase is concentrated and flash chromatographed on silica gel using 50/50 hexane/ethyl acetate (800 ml), ethyl acetate (500 ml) and 80/20 acetone/ methanol (200 ml) (30 fractions X 50 ml). The product (fractions 19-21) was obtained as a yellow gum.

45

EXAMPLE 4

7-chloro-3-hydroxy-3-(4,6-dimethoxy-2-pyrimidinyl)phthalide (Table A, cpd. no. 13)

50

A mixture of 1.8 g of 7-chloro-3-cyano-3-(4,6-dimethoxy-2-pyrimidinyl)phthalide, 50 ml of 1% NaOH and 50 ml of THF are stirred at room temperature for 3 hrs. The THF is removed by evaporation and the mixture is diluted with water and extracted twice with ethyl acetate. The aqueous solution is acidified with 2N-H₂SO₄. The resulting acid solution is extracted with 3 x 100 ml ethyl acetate and the organic phases combined, dried over Na₂SO₄ and concentrated to give a pale yellow solid. This residue is taken up in ethyl acetate and treated with activated charcoal until the yellow base line material is removed to give the title product as a white solid m.p. 188-190°C.

55

EXAMPLE 5

7-chloro-3-methoxy-3-(4,6-dimethoxy-2-pyrimidinyl)phthalide (Table A, cpd. no. 30)

- 5 1.0 g of 7-chloro-3-cyano-3-(4,6-dimethoxy-2-pyrimidinyl)phthalide is slurried in 20 ml of methanol and the solution cooled with ice and 0.6 ml of sodium methoxide added dropwise. After stirring for 10 min a further 1 ml of sodium methoxide is added and stirring continued for 10 min and the mixture is then quenched with 2N H₂SO₄. Methanol is removed on a rotovaporator and the residue partitioned between water and ethyl acetate. The organic phase is dried over Na₂SO₄ and concentrated. Flash chromatography of the residue over silica
10 gel using 25% ethyl acetate/hexane yields a white solid m.p. 180-183°C.

EXAMPLE 6

- a) Methyl 2-chloro-6-(4,6-dimethoxy-2-pyrimidinylcarbonyl)benzoate (Table C, cpd. no. 55), and
15 b) 7-chloro-3-chloro-(4,6-dimethoxy-2-pyrimidinyl)phthalide (Table A, cpd. no. 21)

A mixture of 0.7 g of 7-chloro-3-hydroxy-3-(4,6-dimethoxy-2-pyrimidinyl)phthalide, 30 ml of CCl₄, 2 ml of SOCl₂ and 4 drops of DMF are refluxed at 60° for 1½ hrs. The mixture is then cooled, excess SOCl₂ and CCl₄
20 removed on a rotovaporator. The residue is diluted with 20 ml of CH₂Cl₂ and added to a stirred mixture of 10 ml of methanol and 2 ml of diethylamine. After 2½ hrs the mixture is stripped on a rotovaporator to remove excess CH₂Cl₂ and methanol and the residue partitioned between CH₂Cl₂ (50 ml) and water (50 ml). The organic phase is separated, concentrated and the gummy residue flash chromatographed over silica gel using 80/20 hexane/ethyl acetate (500 ml), 60/40 hexane/ethyl acetate (500 ml) (28 fractions X 50 ml). Fractions 18 to 20
25 yielded title compound a) and fractions 11 to 16 the compound b).

EXAMPLE 7

7-chloro-3-cyano-3-(4,6-dimethoxy-2-pyrimidinyl)phthalide (Table A, cpd. no. 27)

- 30 600 mg of 7-chloro-3-cyanophthalide are added to an ice-cold suspension of hexane washed 60% NaH (160 mg) in DMF (20 ml). After 15 min, 710 mg of 2-methylsulfonyl-4,6-dimethoxypyrimidine are added. After stirring at RT for 1½ hr the mixture is poured onto 200 ml of ice/water acidified with 2N H₂SO₄ and stirred. The precipitate is filtered and dried in a vacuum oven to yield the title product, m.p. 159-161°C.

EXAMPLE 8

7-chloro-3,3-bis(4,6-dimethoxy-1,3,5-triazin-2-yl)phthalide (Table A, cpd. no. 36)

- 40 1.48 g of 7-chlorophthalide are dissolved in 80 ml of THF. The solution is cooled to -70°C and 1.5 M LDA in THF (6 ml) is syringed in at -70°C over 3 min. Stirring is continued for 15 min at -70°, 1.54 g of 2-chloro-4,6-dimethoxy-1,3,5-triazine in 50 ml of THF added dropwise and the mixture is then allowed to warm to -20°. The mixture is again cooled to -70° and 1 ml of conc. HCl in 10 ml of water is added. The mixture is stirred for 25 min and allowed to warm to RT and the THF is removed by evaporation. The residue is partitioned between
45 CH₂Cl₂ and water (50 ml each) and the aqueous phase extracted with an additional 30 ml of CH₂Cl₂. The combined organic phases are washed with 30 ml of water and concentrated to give a yellow gum. This is flash chromatographed on silica gel using 60/40 hexane/ethyl acetate (1000 ml), ethyl acetate (400 ml), 80/20 acetone/ methanol (500 ml) (30 fractions X 50 ml, 1 X 200 ml). Fractions 21 and 22 yielded a yellow gum which upon recrystallization from hexane yielded title product m.p. 126-127° as a yellow solid.

EXAMPLE 9

Lithium 2-chloro-6-(4,6-dimethoxy-α-hydroxy-2-pyrimidinylmethyl)benzoate (Table C, cpd. no. 53)

- 55 A mixture of 1.0 g of 7-chloro-3-(4,6-dimethoxy-2-pyrimidinyl)phthalide, 0.136 g of LiOH.H₂O, 2 ml of water and 10 ml of methanol is stirred overnight at RT. The mixture is evaporated to dryness on a rotovaporator. Further drying in a drying pistol yield the title compound as a white solid, m.p. 153-157°C.

EXAMPLE 10

Lithium 3-[(4,6-dimethoxy- α -hydroxy-2-pyrimidinyl)methyl]pyridine-2-carboxylate (Table D, cpd. no. 64)

- 5 A mixture of 0.490 g of 5-(4,6-dimethoxy-2-pyrimidinyl)furo [3,4,b]pyridine-7(5H)-one, 0.0768 gm of LiOH.H₂O, 10 ml of methanol and 2 ml of water is stirred for 24 hrs under nitrogen at RT and the solvent stripped off. The yellowish solid is dried for a further 2 hrs to yield the title product, m.p. >250°C (decomp.).

EXAMPLE 11

10

Sodium 2-chloro-6-[(4,6-dimethoxy-2-pyrimidinyl)carbonyl]benzoate (Table C, cpd. no. 58)

- 1.24 g of 7-chloro-3-hydroxy-3-(4,6-dimethoxy-2-pyrimidinyl)phthalide, 154 mg NaOH, 25 ml THF and 25 ml water are mixed until a yellow homogenous solution is achieved. The solvents are stripped on a rotovaporator and then on a Kugelrohr at 100°C to produce the title compound as a yellow solid, m.p. 276-278°C.

EXAMPLE 12

20

3-[(4,6-dimethoxy-2-pyrimidinyl)carbonyl]-pyridine-2-carboxylic acid (Table D, cpd. no. 63)

- 490 mg of 5-(4,6-dimethoxy-2-pyrimidinyl)-furo[3,4-b]pyridine-7(5H)one is dissolved in 50 ml of methanol and the mixture heated with stirring at 50°C until a homogenous solution is formed (ca ½ hr). 2.6 g of NaOCl is added dropwise and the solution heated for a further ½ hr at 55°C. 0.208 g of 50% NaOH is added at 55° and the mixture heated for a further ½ hr at this temperature and then cooled in an ice-bath and acidified with 1 ml conc. HCl. The solvent is evaporated and the residue partitioned between 50 ml of CH₂Cl₂ and 50 ml of water. The organic phase is concentrated to give a white solid, m.p. 71-73°.

EXAMPLE 13

30

2-[(4,6-dimethoxy-2-pyrimidinyl)- α -iminomethyl]benzoic acid (Table C, cpd. no. 51)

- 2.67 g of isopropyl 2-bromobenzoate are dissolved in 100 ml of dry diethylether, the solution cooled to -100° C and 6.6 ml of 1.6 M n-butyllithium solution added. Stirring is continued for 10 min and 12 g of 2-cyano-4,6-dimethoxypyrimidine in 60 ml of diethylether is added over 2 min at -100°C. The mixture is stirred for ½ hr at -80° and then allowed to warm to RT. 3 g of NH₄Cl in 30 ml of water is added to the reaction mixture, cooled in an ice-bath. The ether layer is separated off, washed with water (2 x 30 ml) and concentrated. The gummy residue is dissolved in 20 ml of 85/15 hexane/ethyl acetate, and CH₂Cl₂, and flash chromatographed on silica gel using 800 ml 85/15 hexane/ethyl acetate, 500 ml 1% methanol in ethyl acetate, 500 ml 5% methanol in ethyl acetate and 500 ml of 80/20 acetone/methanol (40 fractions at 50 ml; 1 at 200 ml). Fractions 7 to 10 yielded title compound which on recrystallization from CH₂Cl₂ melted at 225-235°C.

EXAMPLE 14

45

5-Chloro-5-(4,6-dimethoxy-2-pyrimidinyl)furo[3,4,b]pyridine-7(5H)one (Table B, cpd. no. 68)

- A mixture of 490 mg of 5-(4,6-dimethoxy-2-pyrimidinyl)furo[3,4,b]pyridine-7(5H)one and 50 ml of methanol is heated at 55° for 1/2 hour or until a homogenous solution is formed. 2.6 g of NaOCl (common house bleach) is added dropwise. The mixture is taken up in dichloromethane and the organic phase separated and evaporated to dryness to yield the title compound.

50

EXAMPLE 15

3-[(4,6-dimethoxy-2-pyrimidinyl)carbonyl]-pyridine-2-carboxylic acid (Table E, cpd. no. 63)

55

- 0.208 g of 50% NaOH is added at 55° to a solution of 0.551 g of 5-chloro-5-(4,6-dimethoxy-2-pyrimidinyl)-furo[3,4,b]pyridine (Table B, cpd. no. 68) in 50 ml methanol. The mixture stirred for a further 1/2 hr at 55°, cooled in an ice-bath, acidified with 1 ml of concentrated HCl and the solvent evaporated. The residue is partitioned between 50 ml of CH₂Cl₂ and 50 ml H₂O and the CH₂Cl₂ layer concentrated to give 0.39 g of the title product

as a white solid, m.p. 71-73°C.

EXAMPLE 16

5 2-(2-(4,4-dimethyl-oxazolin-2-yl)-benzyl)-4,6-dichloropyrimidine (Table C, cpd. no. 61)

To a mixture of 1.25 g of 2-o-tolyl-4,4-dimethyl-oxazoline in 20 ml of ether under N₂ atmosphere at -30°C is added by syringe 4.2 ml of 1.6 M n-butyllithium in hexane with stirring which is continued for 1 hr at -10°C. 0.98 g of 4,6-dichloropyrimidine in 20 ml of ether are added slowly to the reaction mixture which is then stirred at -45 to -30°C for 30 min and at 0°C for a further 30 min. The reaction mixture is quenched with acetic acid (0.4 ml) and water (0.1 ml) in THF (1.3 ml) and then treated with 1.5 g of 2,3-dichloro-5,6-dicyanobenzoquinone (DDQ) in 6 ml of THF. The temperature is brought to RT and the mixture stirred for 5 min after cooling to 0°C. 7.6 ml of 1N NaOH (cooled) are added and the mixture stirred for 5 min. The organic phase is separated and dried over Na₂SO₄ filtered and the solvent removed. Following chromatography (10/90 ether/hexane) the title product is obtained.

EXAMPLE 17

20 2-(2-(4,4-dimethyl-oxazolin-2-yl)-benzyl)-4,6-dimethoxypyrimidine (Table C, cpd. no. 48)

To a solution of 1.7 g of 2-(2-(4,4-dimethyl-oxazolin-2-yl)-benzyl)-4,6-dichloropyrimidine in 100 ml of methanol are added 2.18 g of 25% methanolic NaOCH₃ and the mixture heated for 10 hrs at 65°C with stirring. The temperature is lowered to 60° and stirring continued overnight. The solvent is stripped and the residue taken up in 80 ml of toluene and 50 ml of water. The toluene layer was separated and washed with 50 ml of water, separated and concentrated to give the title compound as a yellow oil.

EXAMPLE 18

30 2-(2-(4,4-dimethyl-oxazolin-2-yl)-α-bromobenzyl)-4,6-dimethoxy pyrimidine (Table C, cpd. no. 62)

0.55 g of 2-(2-(4,4-dimethyl-oxazolin-2-yl)-benzyl)-4,6-dimethoxypyrimidine, 0.30 g of a N-bromosuccinimide, 0.03 g of benzoyl peroxide are dissolved in 60 ml of CCl₄ and heated under reflux overnight at 75°C. The reaction mixture is filtered and the filtrate washed with 5% NaHCO₃ solution (50 ml), 50 ml of water and the organic phase separated and concentrated to give the title compound.

EXAMPLE 19

2-(2-(4,4-dimethyl-oxazolin-2-yl)-benzoyl)-4,6-dimethoxypyrimidine (Table C, cpd. no. 49)

40 A mixture of 1.2 g of 2-(2-(4,4-dimethyl-oxazolin-2-yl)-α-bromobenzyl)-4,6-dimethoxy-pyrimidine and 2 g of Na₂CO₃ in 30 ml of DMSO is heated with stirring at 50-60°C for 3 hrs. The mixture is poured into 150 ml of water and extracted with toluene. The toluene extract is washed twice with water (2 x 50 ml) separated and concentrated. The thus obtained gum is chromatographed with 800 ml of 80/20 hexane/ethyl acetate, 500 ml 70/30 hexane/ethyl acetate, 60/40 ml hexane/ethyl acetate (50 ml fractions) fractions 29 to 34 yielded the title compound.

EXAMPLE 20

50 2-chloro-6-(4,6-dimethoxy-2-pyrimidinylcarbonyl)-benzoic acid dimethylamide (Table C, cpd. no. 57)

1.0 g of 7-chloro-3-cyano-3-(4,6-dimethoxy-2-pyrimidinyl) phthalide is dissolved in 15 ml of THF. 0.7 ml of a 40% aqueous dimethylamine solution is then added via syringe whereupon the solution darkens. Stirring is continued at R.T. for 15 minutes and the mixture diluted with water and partitioned between ethyl acetate and water. The organic phase is separated, washed with 2N H₂SO₄, then brine, dried and concentrated. The residue is purified on silica gel, eluant 200 ml of 50% ethyl acetate/hexane then 100% ethyl acetate. Fractions 12 to 15 yielded the title compound, m.p. 141-142°C.

EXAMPLE 21

3-acetoxy-7-chloro-3-(4,6-dimethoxy-2-pyrimidinyl)phthalide (Table A, cpd. no. 125)

1.1 g of 7-chloro-3-(4,6-dimethoxy-2-pyrimidinyl)-3-hydroxy-phthalide is dissolved in 20 ml of pyridine and 0.3 ml of acetic anhydride added with stirring. After stirring for 20 min the mixture is poured into 2N HCl and extracted with two portions of ethylacetate. The combined ethyl acetate extracts are washed once with 2N HCl, once with H₂O and once with brine and dried over magnesium sulfate. Filtration and evaporation produced the title compound as a white solid, m.p. 213-215°.

EXAMPLE 22

3-[(4,6-dimethoxy- α -hydroxy-2-pyrimidinyl)methyl]pyridine-2-carboxamide (Table E, cpd. no. 82)

To a solution of 0.9 g of ammonia, in 15 ml of methanol, is added 0.5 g of 3-[(4,6-dimethoxy-2-pyrimidinyl)-7-azaphthalide. After stirring for 2 hrs at RT, the methanol is removed under reduced pressure and the concentrate recrystallized from toluene to give the title compound as a white solid, m.p. 135-137°C.

EXAMPLE 23

3-[(4,6-dimethoxy-2-hydroxy-2-pyrimidinyl)methyl]pyridine-2-[carboxy(4-isopropyl)anilide] (Table E, cpd. no. 183)

To a solution of 3 ml of 4-isopropylaniline in 50 ml of toluene is syringed in 4 ml of 15.6% trimethylaluminum in hexane at RT. The mixture is stirred for 0.5 hr at RT and 0.5 g of 3-[(4,6-dimethoxy-2-pyrimidinyl)-7-azaphthalide is added. The mixture is stirred for 2 hrs at RT and acidified with 30 ml of 10% hydrochloric acid at 5-10°C. The toluene solution is separated, washed with 20 ml of 10% hydrochloric acid, 20 ml of 5% sodium carbonate and 20 ml of water, dried and concentrated. The concentrate is recrystallized from hexane to yield the title compound as a white solid, m.p. 113-114°C.

TABLE 24

3-[(4,6-dimethoxy- α -(ethoxycarbonyloxy)-2-pyrimidinyl)methyl]pyridine-2-carboxamide (Table E, cpd. no. 129)

To a solution of 0.5 g of 3-[(4,6-dimethoxy- α -hydroxy-2-pyrimidinyl)methyl]pyridine-2-carboxamide, 0.05 g of 4-(dimethylamino)pyridine, and 1 ml of triethylamine, in 20 ml of toluene and 10 ml of dichloromethane is added 1 ml of ethyl chloroformate at RT. After stirring for 1 hr at ambient temperature, the mixture is washed with water (2x30 ml), dried and concentrated on a rotoevaporator. The concentrate is digested with v/v mixture of hexane-toluene, 10 ml, at 50°C, cooled to RT and filtered to isolate 0.45 g of the title compound as a yellow solid, m.p. 112-114°C.

EXAMPLE 25

3-[(4,6-dimethoxy- α -benzoyloxy-2-pyrimidinyl)methyl]pyridine-2-(N,N-dibenzoyl)carboxamide (Table E, cpd. no. 159)

To a solution of 0.05 g of 3-[(4,6-dimethoxy- α -hydroxy-2-pyrimidinyl)methyl]-2-carboxamide, 0.5 g, 4-(dimethylamino)pyridine and 4 ml of triethylamine in 30 ml of dichloromethane is added 1.4 g of benzoyl chloride at RT in two portions. The reaction mixture is stirred at RT for 17 hrs and washed with 30 ml of water, 30 ml of 5% hydrochloric acid and 30 ml of water. The dichloromethane solution is concentrated and the concentrate flash chromatographed through 300 ml silica gel, 230-400 mesh, using 1 L 70/30 hexane-ethyl acetate and 500 ml 50/50 hexane-ethyl acetate as eluting solvent mixtures. Fractions 18-21 gave after recrystallization from 70/30 hexane ethyl acetate the title compound as a white solid, m.p. 168-170°C.

EXAMPLE 26

3-[(4,6-dimethoxy- α -(N-methylcarbamoyloxy)-2-pyrimidinyl)methyl]-2-pyridine carbox(N-allyl)amide (Table E, cpd. no. 133)

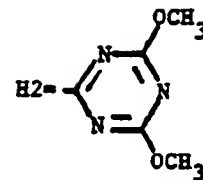
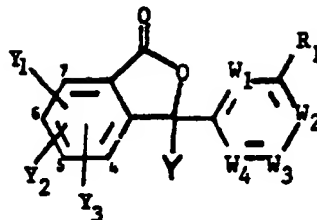
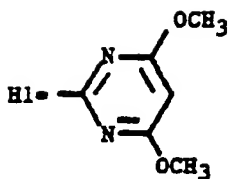
To a solution of 0.5 g of 3-[(4,6-dimethoxy- α -hydroxy-2-pyrimidinyl)methyl]-2-pyridine carbox(N-allyl)amide and 3 drops of triethylamine, in 20 ml of dichloromethane is added 3 ml of methyl isocyanate, in three 1 ml portion/day while stirring at RT for 3 days. The reaction mixture is washed with water (2x50ml), dried and concentrated. The concentrate is flash chromatographed through 300 ml silica gel, 230-400 mesh, using 1 L 50/50 hexane-ethyl acetate, 500 ml ethyl acetate, 500 ml 80/20 ethyl acetate methanol taking 34 fractions (50 m/m). Fractions 21-25 give 0.4 g of the title product as a yellow gum.

The following compounds may be prepared analogously to the preceding examples or as otherwise described herein.

TABLE A

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melting point

	Cpd No	Y ₁	Y ₂	Y ₃	Y	W ₁	W ₂	W ₃	W ₄	R ₁	(° C)
15	1	H	H	H	OH	N	CH	C-OCH ₃	N	OCH ₃	136-138
	2	H	H	H	H	N	CH	C-OCH ₃	N	OCH ₃	102-104
	3	H	H	H	OC(=O)CH ₃	N	C-Br	C-OCH ₃	N	OCH ₃	215-225
20	4	H	H	H	H	N	C-Br	CH	N	OCH ₃	136-138
	5	H	H	5-Cl	H	N	CH	C-OCH ₃	N	OCH ₃	151-153
	6	7-Cl	H	H	H	N	CH	C-OCH ₃	N	OCH ₃	148-149
25	7	H	6-Cl	H	H	N	CH	C-OCH ₃	N	OCH ₃	138-139
	8	H	H	H	H	N	CH	C-Cl	N	OCH ₃	152-153
	9	7-Cl	H	H	H	N	CH	C-Cl	N	OCH ₃	128-130
	10	H	H	4-Cl	H	N	CH	C-OCH ₃	N	OCH ₃	98-99
30	11	7-CH ₃	H	H	H	N	CH	C-OCH ₃	N	OCH ₃	138-140
	12	H	H	H	H	N	CH	C-Cl	N	CH ₃	133-135
	13	7-Cl	H	H	OH	N	CH	C-OCH ₃	N	OCH ₃	188-190
	14	7-Cl	H	H	H	N	CH	C-OiC ₃ H ₇	N	OCH ₃	101-102
35	15	7-OCH ₃	H	4-Br	H	N	CH	C-OCH ₃	N	OCH ₃	126-128
	16	7-Cl	H	H	H	N	CH	C-OCH ₂ CF ₃	N	OCH ₃	112-113
40	17	7-Cl	H	H	H	N	CH	C-OCH ₃	N		136-138
	18	7-Cl	H	H	H	N	CH	C-O-CH ₂ -	N	OCH ₃	115-116
45	19	7-Cl	H	H	H	N	CH	C-OCH ₃	N	-OCH ₂ -	85-88
	20	7-Cl	H	H	H	N	CH	C-OCH ₃	N	-OC ₂ H ₅	98-100
	21	7-Cl	H	H	Cl	N	CH	C-OCH ₃	N	-OCH ₃	163-165
50	22	7-Cl	H	H	H	N	CH	C-OCH ₂ C≡CCH ₃	N	-OCH ₃	131-133

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TABLE A (cont)

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melting point



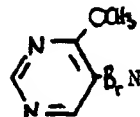

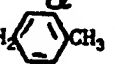






	Cpd No	Y ₁	Y ₂	Y ₃	Y	W ₁	W ₂	W ₃	W ₄	R ₁	(° C)
	23	7-Cl	H	H	SCH ₃	N	CH	C-OCH ₂ C=CCH ₃	N	-OCH ₃	134-136
	24	7-Cl	H	H	H	N	CH	C-OCH ₃	N	-OCH ₂ CH=CH ₂	72-75
10	25	7-Cl	H	H	H	N	N	C-OCH ₃	N	-OCH ₃	157-160
	26	7-OCH ₃	H	H	H	N	CH	C-OCH ₃	N	-OCH ₃	152-154
	27	7-Cl	H	H	CN	N	CH	C-OCH ₃	N	-OCH ₃	159-161
	28	7-Cl	H	H	CN	N	N	C-OCH ₃	N	-OCH ₃	184-186
15	29	7-Cl	6-Cl	H	H	N	CH	C-OCH ₃	N	-OCH ₃	194-195
	30	7-Cl	H	H	OCH ₃	N	CH	C-OCH ₃	N	-OCH ₃	180-183
20	31	7-S- 	H	H	CN	N	CH	C-OCH ₃	N	-OCH ₃	169-171
	32	7-OCH ₃	6-OCH ₃	H	-S- 	N	N	C-OCH ₃	N	-OCH ₃	134-136
25	33	7-Cl	H	H	H	N	CH	C-CH ₃	N	-CH ₃	164-166
	34	H	H	H		N	CH	C-OCH ₃	N	-OCH ₃	163-176
30	35	H	5-Cl	H	"H1"	N	CH	C-OCH ₃	N	-OCH ₃	151-153
	36	7-Cl	H	H	"H2"	N	N	C-OCH ₃	N	-OCH ₃	126-127
	37	H	H	H	OH	N	C-Cl	C-OCH ₃	N	OCH ₃	162-165
35	38	7-F	H	H	CN	N	CH	C-OCH ₃	N	OCH ₃	132-134
	69	7-Cl	H	H	OC ₂ H ₅	N	CH	C-OCH ₃	N	OCH ₃	148-151
	72	7-OCH ₃	H	H	CN	N	CH	C-OCH ₃	N	OCH ₃	159-163
40	73	H	H	H	CH ₃	N	CH	C-OCH ₃	N	OCH ₃	87-89
	75	H	H	H	"H1"	N	CH	C-OCH ₃	N	OCH ₃	168-170
	88	7-Cl	H	H	H	N	CH	C-OCH ₂ - 	N	-OCH ₃	gum, NMR
45	98	7-Cl	H	H	H	N	CH	C-OCH ₂ - 	N	-OCH ₃	97-98
50	101	7-Cl	H	H	H	N	CH	C-OCH ₂ - 	N	-OCH ₃	125-127

TABLE A (cont)

												melting point (° C)
	Cpd No	Y ₁	Y ₂	Y ₃	Y	W ₁	W ₂	W ₃	W ₄	R ₁		
10	102	7-Cl	H	H	H	N	CH	C-OCH ₂	N	-OCH ₃		83-85
	104	7CH ₃ OC ₂ H ₄ - -OCH ₂ O-	H	H	CN	N	CH	C-OCH ₃	N	-OCH ₃		105-108
	105	7CH ₃ OC ₂ H ₄ - -OCH ₂ O-	H	H	OH	N	CH	C-OCH ₃	N	-OCH ₃		109-110
15	109	7-F	H	H	OCH ₃	N	CH	C-OCH ₃	N	-OCH ₃		172-173.5
	113	7-F	H	H	H	N	CH	C-OCH ₃	N	-OCH ₃		138-140
	117	7-F	H	H	OH	N	CH	C-OCH ₃	N	-OCH ₃		183.5-185.5
20	118	7-OH	H	H	OH	N	CH	C-OCH ₃	N	-OCH ₃		121-122
	120	7-O-CH ₂ - 	H	H	CN	N	CH	C-OCH ₃	N	-OCH ₃		174-176
25	125	7-Cl	H	H	acetoxy	N	CH	C-OCH ₃	N	-OCH ₃		213-215
	134	7-OH	H	H	OH	N	CH	C-OCH ₃	N	-OCH ₃		138-141 (decomp)
30	135	7CH ₃ SO ₂ O	H	H	CN	N	CH	C-OCH ₃	N	-OCH ₃		159-161
	137	7-OCOR(C ₂ H ₅) ₂	H	H	CN	N	CH	C-OCH ₃	N	-OCH ₃		123-125
	138	7propargyloxy	H	H	CN	N	CH	C-OCH ₃	N	-OCH ₃		174-175
35	139	7-OCH ₂ - 	H	H	CN	N	CH	C-OCH ₃	N	-OCH ₃		170-171
	140	7-OCH ₂ - 	H	H	CN	N	CH	C-OCH ₃	N	-OCH ₃		169-172
40	145	7-OCH ₂ - 	H	H	H	N	CH	C-OCH ₃	N	-OCH ₃		108-110
	146	7-OCH ₂ - 	H	H	H	N	CH	C-OCH ₃	N	-OCH ₃		115-118
45	147	7-OCH ₃	H	H	OH	N	CH	C-OCH ₃	N	-OCH ₃		174-176
	153	7propargyloxy	H	H	H	N	CH	C-OCH ₃	N	-OCH ₃		130-131

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TABLE A (cont)








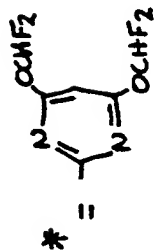
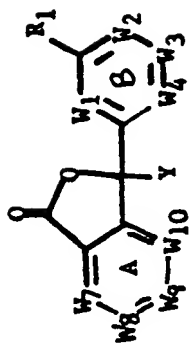
	Cpd No	Y ₁	Y ₂	Y ₃	Y	W ₁	W ₂	W ₃	W ₄	B ₁	melting point (° C)
10	154	7-OCH ₂ - 	H	H	CN	N	CH	C-OCH ₃	N	-OCH ₃	182-185 (decomp)
	166	7-OCF ₃	H	H	OH	N	CH	C-OCH ₃	N	-OCH ₃	131-132
	167	7-OCH ₃	H	H	acetoxo	N	CH	C-OCH ₃	N	-OCH ₃	201-202
15	180	7-OCH ₂ - 	H	H	H	N	CH	C-OCH ₃	N	-OCH ₃	133-136
	190	7-Oallyl	H	H	H	N	CH	C-OCH ₃	N	-OCH ₃	109-110
20	195	7-CF ₃ O	H	H	acetoxo	N	CH	C-OCH ₃	N	-OCH ₃	165-166
	203	7-Cl	H	H	propionoxo	N	CH	C-OCH ₃	N	-OCH ₃	178-180
	204	7-Cl	H	H	hexanoyloxy	N	CH	C-OCH ₃	N	-OCH ₃	131-133
	205	7-Cl	H	H	cyclopropyl- carbonyloxy	N	CH	C-OCH ₃	N	-OCH ₃	177-179
25	208	7-Cl	H	H	benzoyloxy	N	CH	C-OCH ₃	N	-OCH ₃	192-194
	240	7-Cl	H	H	crotonyloxy	N	CH	C-OCH ₃	N	-OCH ₃	158-160
	250	7-Cl	H	4-Cl	OH	N	CH	C-OCH ₃	N	-OCH ₃	171-175
30	253	7-Cl	H	H	cinnamoyloxy	N	CH	C-OCH ₃	N	-OCH ₃	221-224
	256	7-Cl	H	H		N	CH	C-OCH ₃	N	-OCH ₃	102-103
	258	7-Cl	H	H	2-butenoxo	N	CH	C-OCH ₃	N	-OCH ₃	102-103
35	263	7-Cl	H	4-Cl		N	CH	C-OCH ₃	N	-OCH ₃	163-164
	265	7-Cl	H	4-Cl		N	CH	C-OCH ₃	N	-OCH ₃	87-91
40	266	7-Cl	H	4-Cl		N	CH	C-OCH ₃	N	-OCH ₃	137-138
	267	7-Cl	H	4-Cl		N	CH	C-OCH ₃	N	-OCH ₃	128-131
45	268	7-F	H	4-F	CN	N	CH	C-OCH ₃	N	-OCH ₃	135-136
	269	7-Cl	H	4-Cl	CN	N	CH	C-OCH ₃	N	-OCH ₃	123-126
	270	7-Cl	H	4-Cl	H	N	CH	C-OCH ₃	N	-OCH ₃	156-161
50	307	4-Cl	H	H	OH	N	CH	C-OCH ₃	N	-OCH ₃	146-150

TABLE A (cont)

5	<u>Cpd No</u>	<u>Y₁</u>	<u>Y₂</u>	<u>Y₃</u>	<u>Y</u>	<u>W₁</u>	<u>W₂</u>	<u>W₃</u>	<u>W₄</u>	<u>R₁</u>	melting point
											(° C)
	319	4-Cl	H	H	CN	N	CH	C-OCH ₃	N	-OCH ₃	132-133
	320	4-Cl	H	H	OCH ₃	N	CH	C-OCH ₃	N	-OCH ₃	168-168.5
10	326	7-Cl	H	H	OC(=O)C ₃ H ₇	N	CH	C-OCH ₃	N	-OCH ₃	142-143
	409	7-Cl	H	H	OC(=O)C ₄ H ₉	N	CH	C-OCH ₃	N	-OCH ₃	162-163
15											
20											
25											
30											
35											
40											
45											
50											
55											

TABLE B



Cpd No	W7	W6	W8	W10	Y	W1-	W2	W3	W4	R1	melting point (° C)
39	CH	CH	CH	N	H	N	CH	C-OCH3	N	-OCH3	149-151
40	N	CH	CH	CH	H	N	CH	C-OCH3	N	-OCH3	167-168
41	CH	CH	N	CH	H	N	CH	C-OCH3	N	-OCH3	oil NMR
42	CH	N	CH	CH	H	N	CH	C-OCH3	N	-OCH3	120-126
43	N	C-Cl	CH	CH	H	N	CH	C-OCH3	N	-OCH3	166-169
44	N	CH	C-C2H5	CH	H	N	N	C-OCH3	N	-OCH3	oil NMR
45	N	CH	CH	CH	H	N	N	C-OCH3	N	-OCH3	75-80
46	CH	C-C2H5	CH	N	H	N	CH	C-OCH3	N	OCH3	oil NMR
47	CH	CH	CH	N	CH3	N	CH	C-OCH3	N	OCH3	98-101
68	N	CH	CH	CH	Cl	N	CH	C-OCH3	N	OCH3	
70	N	CH	CH	CH	"H1"	N	CH	C-OCH3	N	OCH3	
89	C-CH3	CH	CH	N	H	N	CH	C-OCH3	N	OCH3	173-176
92	N	CH	CH	CH	H	N	CH	C-OCH3, CF3	N	-OCH3	129-131
											116-119

TABLE B (cont)


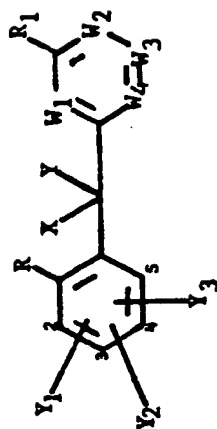
Cpd No	W ₇	W ₈	W ₉	W ₁₀	Y	W ₁₁	W ₂	W ₃	W ₄	R ₁	melting point (° C)
93	N	CH	CH	CH	H	N	CH	C-CH ₃	N	-CH ₃	193-195
94	N	CH	CH	CH	H	N	CH	C-Cl	N	-OCH ₃	147-149
95	N	CH	CH	CH	H	N	CH	C-OCH ₂ - 	N	-OCH ₃	oil NMR
99	N	CH	CH	CH	H	N	CH	C-OC ₃ H ₇	N	-OCH ₃	140-142
100	N	CH	CH	CH	H	N	CH	C-OC ₂ H ₅	N	-OCH ₃	133-135
106	N	CH	CH	CH	H	N	CH	C-Oallyl	N	-OCH ₃	112-114
107	N	CH	CH	CH	H	N	CH	-OCH ₃ -CH=CHCH ₃	N	-OCH ₃	oil NMR
114	C-Cl	N	CH	CH	H	N	CH	C-OCH ₃	N	-OCH ₃	168-170
121	C-OCH ₃	N	CH	CH	H	N	CH	C-OCH ₃	N	-OCH ₃	150-153
136	N	CH	CH	CH	H	N	CH	C-OCH ₃	N	H	(decomp)
141	N	CH	CH	CH	*	N	CH	C-OCHF ₂	N	OCHF ₂	158-160
148	CH	CH	CH	N	"H1"	N	CH	C-OCH ₃	N	OCH ₃	145-147
175	CH	CH	CH	N	OH	N	CH	C-OCH ₃	N	OCH ₃	212-213
260	C-CH ₃	N	CH	CH	OH	N	CH	C-OCH ₃	N	OCH ₃	172-178
											203-204

TABLE B (cont.)

Cpd No	W ₇	W ₈	W ₉	W ₁₀	Y	W ₁₁	W ₂	W ₃	W ₄	R ₁	melting point
											(° C)
261	C-COOH	N	CH	CH	OH	N	CH	C-OCH ₃	N	OCH ₃	130-132 (decomp)
317	N	CH	CH	CH	H	N	CH	C-OCH ₃	N	CH ₃	138-140
408	N	CH	CH	CH	-N(CH ₃)OCH ₃	N	CH	C-OCH ₃	N	OCH ₃	168-170

TABLE C



Opd. #	X ₁	Y ₂	Y ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	melting point (° C)
48	H	H	H		H	H	N	CH	C-OCH ₃	N	-OCH ₃	oil NMR
49	H	H	H	—H—	—O—		N	CH	C-OCH ₃	N	-OCH ₃	oil NMR
50	H	H	H		H	H	N	CH	C-OCH ₃	N	-OCH ₃	150-152
51	H	H	H	COOH	—NH		N	CH	C-OCH ₃	N	-OCH ₃	225-235 (free acid)
52	2-Cl	H	H	CN	H	H	N	CH	C-OCH ₃	N	-OCH ₃	94-95
53	2-Cl	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	-OCH ₃	153-157 (Li ⁺ salt)

TABLE G (cont.)





Cpd #	Y ₁	Y ₂	Y ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	melting point (° C) oil NMR
54	2-Cl	H	H	-CO-N- 	OH	OCH ₃	N	CH	C-OCH ₃	N	-OCH ₃	110-111 130-132 141-142 276-278 (Na ⁺ salt)
55	2-Cl	H	H	-COOCH ₃		-O	N	CH	C-OCH ₃	N	-OCH ₃	
56	2-Cl	H	H	-CONHCH ₃	OH	H	N	CH	C-OCH ₃	N	-OCH ₃	
57	2-Cl	H	H	-CON(CH ₃) ₂		-O	N	CH	C-OCH ₃	N	-OCH ₃	
58	2-Cl	H	H	COOH		-O	N	CH	C-OCH ₃	N	-OCH ₃	
59	2-Cl	H	H	CONH- 	OCH ₃	H	N	CH	C-OCH ₃	N	-OCH ₃	148-150
60	H	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	-OCH ₃	185 (dec.) (Li ⁺ salt) NMR
61	H	H	H		H	H	N	CH	C-Cl	N	Cl	
62	H	H	H		Br	H	N	CH	C-OCH ₃	N	OCH ₃	
71	H	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	158-160 (Li ⁺ salt) >250 (Li ⁺ salt) 66-67
74	H	H	H	COOH	OH	CH ₃	N	CH	C-OCH ₃	N	OCH ₃	
76	2-Cl	H	H	COOC ₂ H ₅		-O	N	CH	C-OCH ₃	N	OCH ₃	
77	2Cl	H	H	COOallyl		-O	N	CH	C-OCH ₃	N	OCH ₃	81-83

TABLE C (cont.)

Cpd #	X ₁	X ₂	X ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	melting point (° C)
78	2Cl	H	H	COObuten-3-yl		-O	N	CH	C-OCH ₃	N	OCH ₃	48-50
79	2Cl	H	H	COObenzyl		-O	N	CH	C-OCH ₃	N	OCH ₃	99-101
80	2Cl	H	H	-CO-N- iC ₃ H ₇		OH	N	CH	C-OCH ₃	N	OCH ₃	99-101
81	2Cl	H	H	-CO-N- CH ₃		OH	N	CH	C-OCH ₃	N	OCH ₃	153-154
85	2Cl	H	H	-CO-N(C ₂ H ₅) ₂		-O	N	CH	C-OCH ₃	N	OCH ₃	110-111
86	H	H	H	COObenzyl	OH	H	N	CH	C-OCH ₃	N	OCH ₃	oil NMR
87	H	H	H	-CO-N- phenyl		OH	N	CH	C-OCH ₃	N	OCH ₃	161-163
96	2-Cl	H	H	-CO-N(C ₂ H ₅) ₂	OH	H	N	CH	C-OCH ₃	N	OCH ₃	74-80
103	2-Cl	H	H	-CONCH ₃ (benzyl)		-O	N	CH	C-OCH ₃	N	OCH ₃	105-107
115	2-F	H	H	-COOCH ₃		-O	N	CH	C-OCH ₃	N	OCH ₃	101-104
116	2-F	H	H	-COOallyl		-O	N	CH	C-OCH ₃	N	OCH ₃	97-99
122	H	H	H	-COOallyl		-O	N	CH	C-OCH ₃	N	OCH ₃	92-93
123	2-Cl	H	H	-COO 2-methyl- -allyl		-O	N	CH	C-OCH ₃	N	OCH ₃	137-139
124	2-Cl	H	H	-COO-3-methyl- -but-2-enyl		-O	N	CH	C-OCH ₃	N	OCH ₃	54-57
126	2-Cl	H	H	-COOpropargyl		-O	N	CH	C-OCH ₃	N	OCH ₃	138-140
143	2-Cl	H	H	-COObut-2-enyl		-O	N	CH	C-OCH ₃	N	OCH ₃	61-65
156	2-OCH ₃	H	H	-COOCH ₃		-O	N	CH	C-OCH ₃	N	OCH ₃	142-143
163	2-F	H	H	-COOH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	Li ⁺ salt
												220-240 (decomp)

TABLE C (cont.)


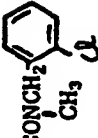
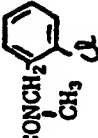


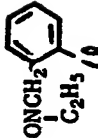
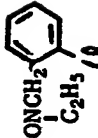
Gpd. #	X ₁	X ₂	X ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	melting point (° C)
165	2-OCH ₃	H	H	-COOallyl	OH	-O	N	CH	C-OCH ₃	N	OCH ₃	100-101
181	2-OCH ₂ - 	OH	H	COOH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	Li ⁺ salt
191	2-CF ₃ O	H	H	COOCH ₃	OH	-O	N	CH	C-OCH ₃	N	OCH ₃	158-159
192	3-Cl	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	80-82 (decomp) Li ⁺ salt
194	5-Cl	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	170-174 (decomp) Li ⁺ salt
197	4-Cl	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	225-227 (decomp) Li ⁺ salt
202	2-pro-pargyloxy	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	195-198 (decomp) Li ⁺ salt
218	2-Cl	H	H	 CONCH ₂ - 	OH	-O	N	CH	C-OCH ₃	N	OCH ₃	>200 (decomp) oil NMR
219	2-Cl	H	H	 CONCH ₂ - 	OH	-O	N	CH	C-OCH ₃	N	OCH ₃	127-128
220	2-Cl	H	H	 CONCH ₂ - 	OH	-O	N	CH	C-OCH ₃	N	OCH ₃	154-155
222	2-OC ₃ H ₇	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	Li ⁺ salt >273 (decomp)

TABLE C (cont.)

Cpd #	X ₁	Y ₂	Y ₃	R	X	Y	M ₁	M ₂	M ₃	M ₄	R ₁	melting point (°C)
228	2-Cl	5-Cl	H	COOH		-O	N	CH	C-OCH ₃	N	OCH ₃	Na ⁺ salt >210 (decomp)
235	2-Cl	5-Cl	H	COOH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	Na ⁺ salt >205 (decomp) 86-87
239	2-Cl	H	H	COOCH ₂ - -CH-CH-Cl		-O	N	CH	C-OCH ₃	N	OCH ₃	112-113
242	2-Cl	H	H	CON-"H1" CH ₃	OCH ₃	H	N	CH	C-OCH ₃	N	OCH ₃	Na ⁺ salt >295 (decomp) Li ⁺ salt 276 (decomp) 63-65 130-132 107-108 89-90 oil NMR Na ⁺ salt >295 (decomp) NMR 70-71 NMR
243	H	H	H	COOH		-O	N	CH	C-OCH ₃	N	OCH ₃	
244	2-F	H	H	COOH		-O	N	CH	C-OCH ₃	N	OCH ₃	
247	2-Cl	H	H	COOC ₃ H ₇		-O	N	CH	C-OCH ₃	N	OCH ₃	
249	2-Cl	5-Cl	H	COOCH ₃		-O	N	CH	C-OCH ₃	N	OCH ₃	
251	2-Cl	H	H	COOCH ₂ CH=CHCl		-O	N	CH	C-OCH ₃	N	OCH ₃	
262	2-Cl	5-Cl	H	COOallyl		-O	N	CH	C-OCH ₃	N	OCH ₃	
264	2-Cl	5-Cl	H	COOC ₁₂ H ₂₅		-O	N	CH	C-OCH ₃	N	OCH ₃	
274	2-F	5-F	H	COOH		-O	N	CH	C-OCH ₃	N	OCH ₃	
277	2-Cl	H	H	COOC ₄ H ₉		-O	N	CH	C-OCH ₃	N	OCH ₃	
281	2-Cl	H	H	COOC ₅ H ₁₁		-O	N	CH	C-OCH ₃	N	OCH ₃	
287	2-Cl	H	H	COOC ₆ H ₁₃		-O	N	CH	C-OCH ₃	N	OCH ₃	
299	2-Cl	H	H	COOC ₇ H ₁₅		-O	N	CH	C-OCH ₃	N	OCH ₃	

TABLE C (cont.)

Cpd. #	X ₁	Y ₂	Y ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	melting point (° C)
300	2-Cl	H	H	COOC ₃ H ₁₇		-O	N	CH	C-OCH ₃	N	OCH ₃	NMR
306	5-Cl	H	H	COOH		-O	N	CH	C-OCH ₃	N	OCH ₃	Na ⁺ salt
308	2-Cl	H	H	COOC ₁₂ H ₂₅		-O	N	CH	C-OCH ₃	N	OCH ₃	266-276 (decomp)
314	2-Cl	H	H	COOCH ₂ C(CH ₃) ₂ H ₅		-O	N	CH	C-OCH ₃	N	OCH ₃	NMR
315	2-Cl	H	H	CH ₂ OH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	92-94
316	2-Cl	H	H	COOC ₃ H ₇		-O	N	CH	C-OCH ₃	N	OCH ₃	115-116
321	5-Cl	H	H	COOCH ₃		-O	N	CH	C-OCH ₃	N	OCH ₃	109-110
												115-116

35

TABLE D (cont.)

Cpd No	A (anticlockwise)*	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	melting point (° C)
179	-C-N-CH-CH- OCH ₃	COOH	H	H	N	CH	C-OCH ₃	N	OCH ₃	Li ⁺ salt >240 (decomp) 147-149
186	-C-N-CH-CH- OCH ₃	COOCH ₃		-O	N	CH	C-OCH ₃	N	OCH ₃	
187	-C-N-CH-CH- OCH ₃	COOH		-O	N	CH	C-OCH ₃	N	OCH ₃	Na ⁺ salt 235 125-126
198	-C-N-CH-CH- OCH ₃	COOCH ₃	Br	H	N	CH	C-OCH ₃	N	OCH ₃	
199	-CH-CH-CH-N-	COOH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	Na ⁺ salt 242 (decomp) oil NMR
206	-C-N-CH-CH- OCH ₃	COOCH ₃	acetoxy	H	N	CH	C-OCH ₃	N	OCH ₃	
216	-C-N-CH-CH- OCH ₃	COOC ₂ H ₅	H	H	N	CH	C-OCH ₃	N	OCH ₃	oil NMR
236	-C-N-CH-CH- CH ₃	COOC ₂ H ₅	Br	H	N	CH	C-OCH ₃	N	OCH ₃	oil NMR
237	-C-N-CH-CH- CH ₂ Br	COOC ₂ H ₅	Br	H	N	CH	C-OCH ₃	N	OCH ₃	oil NMR
238	-C-N-CH-CH- CH ₂ OCOCH ₃	COOC ₂ H ₅	Br	H	N	CH	C-OCH ₃	N	OCH ₃	oil NMR
248	-C-N-CH-CH- CH ₃	COOC ₂ H ₅		-O	N	CH	C-OCH ₃	N	OCH ₃	103-104

TABLE D (cont.)




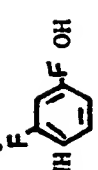



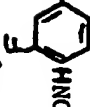

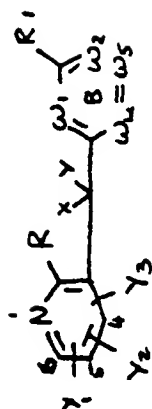
Cpd No	A (<i>anti clockwise</i>) [*]	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	melting point (° C)
254	-C-N-CH-CH- CH ₃	COOH		-O	N	CH	C-OCH ₃	N	OCH ₃	180-185 (decomp) 69-72 K ⁺ salt
301	-CH-CH-CH-N-	CON(C ₂ H ₅) ₂	H	H	N	CH	C-OCH ₃	N	OCH ₃	220-230 (decomp) oil NMR
302	-CH-CH-CH-N-	COOH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	136-138
330	-CH-CH-CH-N-	CON(C ₂ H ₅) ₂	OC ₆ H ₉	H	N	CH	C-OCH ₃	N	OCH ₃	
414	-N-CH-CH-CH-	-C-N- O		OH	N	CH	C-OCH ₃	N	OCH ₃	
415	-CH-CH-CH-N-	CON- CH ₃		-O	CH	CH	CH	CH	CF ₃	
416	-CH-CH-CH-N-	CON- CH ₃		H	CH	CH	CH	CH	CF ₃	
417	-CH-CH-CH-N-	CONH- F		H	CH	CH	CH	CH	CF ₃	
418	-CH-CH-CH-N-	CONH		H	CH	CH	CH	CH	CF ₃	
419	-N-CH-CH-CH-	-CON- CH ₃		-O	CH	CH	CH	CH	CF ₃	

TABLE D (cont.)

Cpd No	A (<i>anti-clockwise</i>)*	R	X	Y	M ₁	M ₂	M ₃	M ₄	R ₁	melting point (° C)
420	-N-CH-CH=CH-	-CONH- 	OH	H	CH	CH	CH	CH	CF ₃	
421	-N-CH-CH=CH-	-CONH- 	F	H	CH	CH	CH	CH	CF ₃	
422	-N-CH-CH=CH-	-CONH- 	OH	H	CH	CH	CH	CH	CF ₃	

*Left hand atom attached to R-bearing carbon

TABLE F



Cpd. #	X ₁	X ₂	X ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	B ₁	m.p.
63	H	H	H	COOH	OH	-O	N	CH	C-OCH ₃	N	OCH ₃	164-166
64	H	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	>250 (K ⁺ salt)
82	H	H	H	CONH ₂	OH	H	N	CH	C-OCH ₃	N	OCH ₃	135-137
83	H	H	H	CONHbenzyl	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
84	H	H	H	CONHallyl	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
91	H	H	H	COOCH ₃	OH	-O	N	CH	C-OCH ₃	N	OCH ₃	119-121
97	H	H	H	COObenzyl	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
108	H	H	H	CONHCH ₃	OH	H	N	CH	C-OCH ₃	N	OCH ₃	127-129
110	H	H	H	CONHC ₃ H ₇	OH	H	N	CH	C-OCH ₃	N	OCH ₃	oil NMR
111	H	H	H	CONHC ₆ H ₁₃	OH	H	N	CH	C-OCH ₃	N	OCH ₃	67-69
112	H	H	H	CONH(1)C ₃ H ₇	OH	H	N	CH	C-OCH ₃	N	OCH ₃	oil NMR
127	H	H	H	CONHallyl	benzoyloxy	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
128	H	H	H	CONHallyl	acetoxy	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
129	H	H	H	CONH ₂	ethoxy-carbonyloxy	H	N	CH	C-OCH ₃	N	OCH ₃	112-114

(64: free acid m.p. 90-92°; sodium salt m.p. >190°; potassium salt m.p. >230°)
(decomp)

TABLE E (cont.)





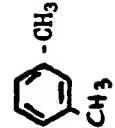
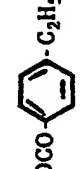

Gpd #	Y ₁	Y ₂	Y ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	E.P.L.
130	H	H	H	CONHC ₁₂ H ₂₅	OH	H	N	CH	C-OCH ₃	N	OCH ₃	o11 NMR
131	H	H	H	CONHC ₂ H ₄ OCH ₃	OH	H	N	CH	C-OCH ₃	N	OCH ₃	79-80
132	H	H	H	CONH ₂ NH ₂	OH	H	N	CH	C-OCH ₃	N	OCH ₃	75-78
133	H	H	H	CONHallyl	OCONHCH ₃	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
144	H	H	H	CONHpropargyl	OH	H	N	CH	C-OCH ₃	N	OCH ₃	102-104
151	H	H	H	 CONH-CH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	o11 NMR
152	H	H	H	CONH-CH ₂ - 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	o11 NMR
155	H	H	H	CONHC ₁₀ H ₁₇	OH	H	N	CH	C-OCH ₃	N	OCH ₃	64-66
157	H	H	H	CONHCH ₂ - 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	102-104
158	H	H	H	CONH ₂	benzoyloxy	H	N	CH	C-OCH ₃	N	OCH ₃	115-116
159	H	H	H	CON(benzoyl) ₂	benzoyloxy	H	N	CH	C-OCH ₃	N	OCH ₃	168-170
160	H	H	H	CONH CH ₂ - 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	88-90
161	H	H	H	CONH ₂	 OCO- 	H	N	CH	C-OCH ₃	N	OCH ₃	138-140

TABLE E (cont.)

Cpd #	Y ₁	Y ₂	Y ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	M.P.
162	H	H	H	CON(CO-C ₆ H ₄ -C ₂ H ₅) ₂	OCO-C ₆ H ₄ -C ₂ H ₅	H	N	CH	C-OCH ₃	N	OCH ₃	198-200
164	H	H	H	CONHCH ₂ -C ₆ H ₄ -OCH ₃	OH	H	N	CH	C-OCH ₃	N	OCH ₃	91-94
168	H	H	H	CONHCH ₂ -C ₆ H ₄ -NO ₂	OH	H	N	CH	C-OCH ₃	N	OCH ₃	103-106
169	H	H	H	-C(=O)-N(C ₆ H ₄ -C ₂ H ₅) ₂		H	N	CH	C-OCH ₃	N	OCH ₃	135-137
170	H	H	H	CONHNH(C ₂ H ₅)	OH	H	N	CH	C-OCH ₃	N	OCH ₃	109-110
171	H	H	H	CONHCH ₂ -C ₆ H ₄ -C ₂ H ₅	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
172	H	H	H	CONHCH ₂ -C ₆ H ₄ -NH ₂	OH	H	N	CH	C-OCH ₃	N	OCH ₃	140-142
177	H	H	H	CONHC ₂ H ₄ N(CH ₃) ₂	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
182	H	H	H	CONHNH-C ₆ H ₅	OH	H	N	CH	C-OCH ₃	N	OCH ₃	117-120

TABLE E (cont.)





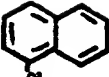

Cpd #	Y ₁	Y ₂	Y ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	m.p.
183	H	H	H	CONH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	132-133
184	H	H	H	CONH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	113-114
185	H	H	H	CONHSO ₂ CH ₃	OH	H	N	CH	C-OCH ₃	N	OCH ₃	133-135
188	H	H	H	CONH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	115-117
189	H	H	H	CONHCH ₂ COOCH ₃	OH	H	N	CH	C-OCH ₃	N	OCH ₃	97-99
193	H	H	H	CONHCH(COCH ₃) ₂	OH	H	N	CH	C-OCH ₃	N	OCH ₃	oil NMR
196	H	H	H	CONHCH ₂ - 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	oil NMR
199	H	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	Na ⁺ salt 89-91
200	H	H	H	CONHCH ₂ - 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	144-146
201	H	H	H	CONHCH ₂ - 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	oil NMR

TABLE E (cont.)









Cpd #	X ₁	Y ₁	Y ₂	Y ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	M.P.
207	H	H	H	H	CONH ₂	dichloro- acetoxy	H	N	CH	C-OCH ₃	N	OCH ₃	118-119
209	H	H	H	H	CONHCH ₂ -phenyl 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
210	H	H	H	H	CONHCH ₂ - 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	119-121
211	H	H	H	H	CONHCH ₂ - 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	125-127
212	H	H	H	H	CONHCH ₂ - 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	oil NMR
213	H	H	H	H	CONHCH ₂ - 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	oil NMR
214	H	H	H	H	CONHCH ₂ - 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	oil NMR
215	H	H	H	H	CONH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	119-120
217	H	H	H	H	CONH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	182-183

TABLE E (cont.)




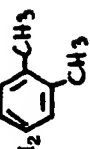






Cpd. #	Y ₁	Y ₂	Y ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	m.p.
221	H	H	H	CONHCH ₂ 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	105-106
223	H	H	H	CONHCH ₂ 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	130-131
224	H	H	H	CONHNH 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	149-150
225	H	H	H	CONHCH ₂ 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	98-100
226	H	H	H	CONH-N 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	40-42
227	H	H	H	CONHC ₂ H ₄ -N 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
229	H	H	H	CONHNH 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	121-123
230	H	H	H	CONHNH 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	130-132
231	H	H	H	CONH 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	138-140
232	H	H	H	CONH 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	152-154
233	H	H	H	CONHC ₃ H ₈ (CH ₃) ₂	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
234	H	H	H	CONHC ₂ H ₄ N(C ₂ H ₅) ₂	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR

TABLE E (cont.)


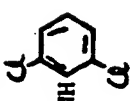

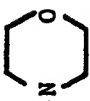

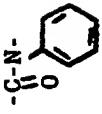
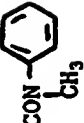
TABLE E (cont.)												
Cpd #	Y ₁	Y ₂	Y ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	m.p. Li ⁺ salt
241	H	H	H	COOH	OH	"H1"	N	CH	C-OCH ₃	N	OCH ₃	158-160
245	H	H	H	CONHNH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	150-154
246	H	H	H	CONHNH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	133-134
252	H	H	H	CONHNH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	150-151
255	H	H	H	CONH-N 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	52-54
257	H	H	H	CONHNHCH ₂ - 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
259	H	H	H	CONHC ₈ H ₁₇	OH	H	N	CH	C-OCH ₃	N	OCH ₃	54-56
271	H	H	H		OH	N	CH	C-OCH ₃		N	OCH ₃	137-138
272	H	H	H	COOH	-O		N	CH	C-OCH ₃	N	OCH ₃	Li ⁺ salt
273	H	H	H	CON- 	-O		N	CH	C-OCH ₃	N	OCH ₃	210 (decomp) 147-149

TABLE E (cont.)



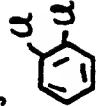
Cpd. #	X ₁	X ₂	X ₃	R	X	Y	M ₁	M ₂	M ₃	M ₄	R ₁	m.p.
275	H	H	H	CONHNH 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	158-160
276	H	H	H	COOH	-O		N	CH	C-OCH ₃	N	OCH ₃	Na ⁺ salt 195 (decomp) K ⁺ salt (255 decomp) 45-47 49-51
278	H	H	H	CONHC ₉ H ₁₉	OH	H	N	CH	C-OCH ₃	N	OCH ₃	58-62
279	H	H	H	CONHC ₁₀ H ₂₁	OH	H	N	CH	C-OCH ₃	N	OCH ₃	103-105
280	H	H	H	CONHNH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
282	H	H	H	CONHCH ₂ iPr	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
283	H	H	H	CONHCH ₂ CH(OCH ₃) ₂	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
284	H	H	H	CONH-C(CH ₃) ₂ -C≡CH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
285	H	H	H	CONHC ₄ H ₉	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
286	H	H	H	CONHCH-CH ₂ OCH ₃ 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
288	H	H	H	CONHNH 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	182-184

TABLE E (cont.)

Cpd. #	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	m.p.
289	OH	H	N	CH	C-OCH ₃	N	OCH ₃	181-183
290	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
291	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
292	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
293	OH	H	N	CH	C-OCH ₃	N	OCH ₃	131-132
294	OH	H	N	CH	C-OCH ₃	N	OCH ₃	124-126
295	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
296	OH	H	N	CH	C-OCH ₃	N	OCH ₃	88-90
297	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR

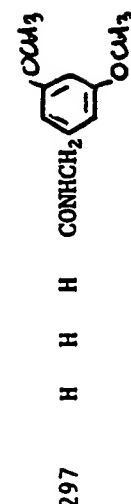
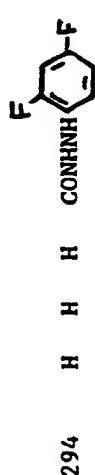
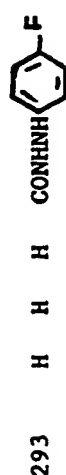
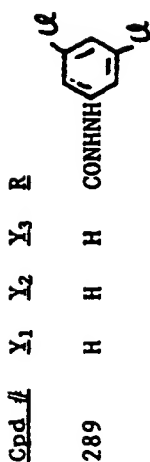


TABLE E (cont.)

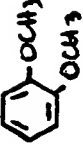








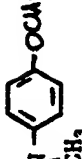
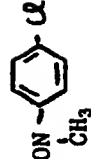
Cpd #	Y ₁	Y ₂	Y ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	m.p. NMR
298	H	H	H	CONHCH ₂ CHCH ₃ OH	OH	H	N	CH	C-OCH ₃	N	OCH ₃	
303	H	H	H	CONH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	NMR
304	H	H	H	CONH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	54-56
305	H	H	H	CONHC()CH ₃	OH	H	N	CH	C-OCH ₃	N	OCH ₃	D(+) 64-68 L(-) NMR
309	H	H	H	CONH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	133-134
310	H	H	H	CONH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	102-104
311	H	H	H	CONH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	122-123
312	H	H	H	CONHNH- 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	126-128
313	H	H	H	CONHCH ₂ - 	OH	H	N	CH	C-OCH ₃	N	OCH ₃	106-108

TABLE E (cont.)

Cpd #	Y ₁	Y ₂	Y ₃	R	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	M.P.
318	H	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	CH ₃	Li ⁺ salt
322	H	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	CH ₃	185-188 (decomp) Li ⁺ salt
323	H	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	H	>195 (decomp) Li ⁺ salt
324	H	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	OC ₂ H ₅	>225 (decomp) Li ⁺ salt
325	H	H	H	COOH	OH	H	N	CH	C-OCH ₃	N	Cl	195 (decomp) Li ⁺ salt
327	H	H	H	CONH- 	H	H	N	CH	C-OCH ₃	N	OCH ₃	225 (decomp) 96-98
328	H	H	H	CON- 	-O	H	N	CH	C-OCH ₃	N	OCH ₃	114-116
329	H	H	H	CON- 	-O		N	CH	C-OCH ₃	N	OCH ₃	146-148
379	H	H	H	CON(C ₂ H ₅) ₂	OH		N	CH	C-OCH ₃	N	OCH ₃	
380	H	H	H	CON(C ₂ H ₅) ₂		H	N	CH	C-OCH ₃	N	OCH ₃	
381	H	H	H	CON(C ₃ H ₇) ₂			N	CH	C-OCH ₃	N	OCH ₃	
382	H	H	H	CON(C ₃ H ₇) ₂	OH	H	N	CH	C-OCH ₃	N	OCH ₃	
383	H	H	H	CON-OCH ₃ CH ₃	-O		N	CH	C-OCH ₃	N	OCH ₃	







Cpd. #	Y				X	TABLE E (cont.)						M ₃	M ₄	R ₁	M.P.
	Y ₁	Y ₂	Y ₃	B		Y	M ₁	M ₂	Y						
384	H	H	H	CON-OCH ₃ CH ₃	OH	H	N	CH	C-OCH ₃	N	N	OCH ₃			
385	H	H	H	CON(CH ₃) ₂			N	CH	C-OCH ₃	N	N	OCH ₃			
386	H	H	H	CON(CH ₃) ₂	OH	H	N	CH	C-OCH ₃	N	N	OCH ₃			
387	H	H	H	CON-N(CH ₃) 			N	CH	C-OCH ₃	N	N	OCH ₃			
388	H	H	H	CON-N(CH ₃) 	OH	H	N	CH	C-OCH ₃	N	N	OCH ₃			
389	H	H	H	CON 			N	CH	C-OCH ₃	N	N	OCH ₃			
390	H	H	H	CON 	OH	H	N	CH	C-OCH ₃	N	N	OCH ₃			
391	H	H	H	CON 			N	CH	C-OCH ₃	N	N	OCH ₃			
392	H	H	H	CON 	OH	H	N	CH	C-OCH ₃	N	N	OCH ₃			
393	H	H	H	CONC ₆ H ₁₃ CH ₃			N	CH	C-OCH ₃	N	N	OCH ₃			
394	H	H	H	CONC ₆ H ₁₃ CH ₃	OH	H	N	CH	C-OCH ₃	N	N	OCH ₃			

TABLE E (cont.)



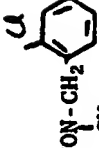
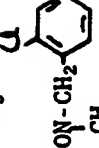
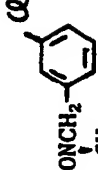
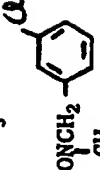


Cpd #	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	m.p.
395		-O-	N	CH	C-OCH ₃	N	OCH ₃	
396			H	CH	C-OCH ₃	N	OCH ₃	
397		-O-	N	CH	C-OCH ₃	N	OCH ₃	
398			H	CH	C-OCH ₃	N	OCH ₃	
399		-O-	N	CH	C-OCH ₃	N	OCH ₃	
400			H	CH	C-OCH ₃	N	OCH ₃	
401		-O-	N	CH	C-OCH ₃	N	OCH ₃	
402			H	CH	C-OCH ₃	N	OCH ₃	

TABLE E (cont.)

Cpd. #	X	Y	W ₁	W ₂	W ₃	W ₄	R ₁	M.P.
403		-O	N	CH	C-OCH ₃	N	OCH ₃	
404		H	N	CH	C-OCH ₃	N	OCH ₃	
405		-O	N	CH	C-OCH ₃	N	OCH ₃	
406		H	N	CH	C-OCH ₃	N	OCH ₃	
407		H	N	CH	C-OCH ₃	N	OCH ₃	gum NMR
411		H	N	CH	C-OCH ₃	N	OCH ₃	gum NMR
413		-O	N	CH	C-OCH ₃	N	OCH ₃	gum NMR

TABLE F

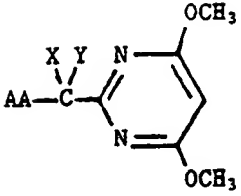
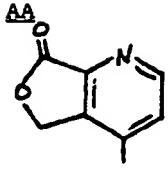
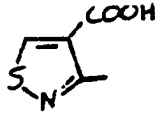
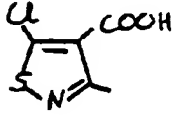
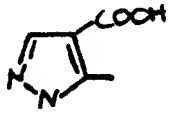
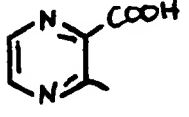
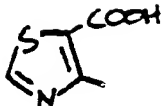
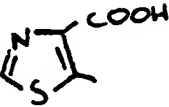
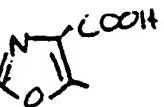
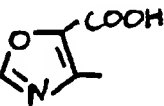
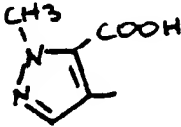
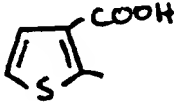
5									
10									
	<u>Cpd. #</u>	<u>AA</u>		<u>X</u>	<u>Y</u>	<u>m.p.</u>			
15	90			H	H	123-125			
20	331								
25	332	— n —		OH	H				
30	333								
35	334	— n —		OH	H				
40	335								
45	336	— n —		OH	H				
	337								
50	338	— n —		OH	H				
55									

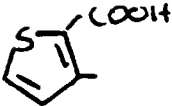
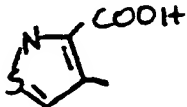
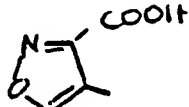
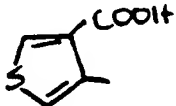
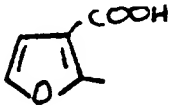
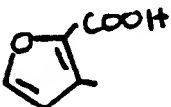
TABLE F (cont.)

	<u>Gpd. #</u>	<u>AA</u>	<u>X</u>	<u>Y</u>	<u>m.p.</u>
5	339			-O	
	340	— II —	OH	H	
10	341			-O	
15	342	— II —	OH	H	
20	343			-O	
	344	— II —	OH	H	
25	345			-O	
30	346	— II —	OH	H	
35	347			-O	
	348	— II —	OH	H	
40	349			-O	
45	350	— II —	OH	H	

50

55

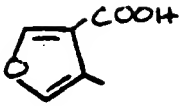
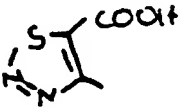
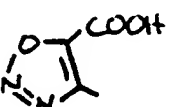
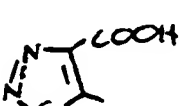
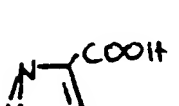
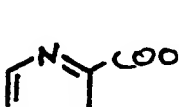
TABLE F (cont)

	<u>Cpd #</u>	<u>AA</u>	<u>X</u>	<u>Y</u>	<u>m.p.</u>
5	351			-O	
	352	— " —	OH	H	
10					
	353			-O	
15	354	— " —	OH	H	
20	355			-O	
	356	— " —	OH	H	
25					
	357			-O	
30	358	— " —	OH	H	
35	359			-O	
	360	— " —	OH	H	
40					
	361			-O	
45	362	— " —	OH	H	

50

55

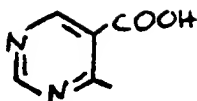
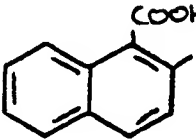
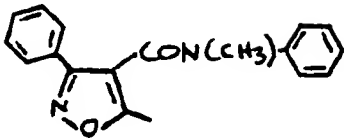
TABLE F (cont)

	<u>Cpd. #</u>	<u>AA</u>	<u>X</u>	<u>Y</u>	<u>m.p.</u>
5	363			-O	
	364	— II —	OH	H	
10					
	365			-O	
15	366	— II —	OH	H	
20	367			-O	
	368	— II —	OH	H	
25					
	369			-O	
30	370	— II —	OH	H	
35	371			-O	
	372	— II —	OH	H	
40					
	373			-O	
45	374	— II —	OH	H	

50

55

TABLE F (cont)

Cpd #	AA	X	Y	m.p.
375			-O	
376	— ii —	OH	H	
377			-O	
378	— ii —	OH	H	
410		H	H	122-123
412	— ii —	H	OtC ₄ H ₉	gum NMR

Compounds of Table F wherein COOH is replaced by other meanings of R as listed in Tables C, D and E above for R may be prepared analogously.

NMR data [¹H nmr (CDCl₃)]

NMR data [¹H nmr (CDCl₃)]

Cpd No	
41	δ: 3.95 (s, 6H, OCH ₃), 5.95 (s, 1H, pyrimidine H), 6.45 (s, 1H, OCH), 7.7-9.1 (m, 3H, pyridine H).
44	δ: 1.32 (t, 3H, CH ₃), 2.87 (q, 2H, CH ₂), 4.05 (s, 6H, OCH ₃), 6.3 (s, 1H, OCH), 7.82 (d, 1H, arom.), 8.72 (d, 1H, arom.).
46	δ: 1.32 (t, 3H, CH ₃), 2.85 (q, 2H, CH ₂), 3.87 (s, 6H, OCH ₃), 5.97 (s, 1H, pyrimidine H), 6.32 (s, 1H, OCH), 8.08 (d, 1H, pyridine H), 8.71 (d, 1H, pyridine H).
48	δ: 1.25 (s, 6H, CH ₃), 3.85 (s, 6H, OCH ₃), 3.95 (2H, OCH ₂), 4.65 (s, 2H, CH ₂), 5.85 (s, 1H, pyrimidine H), 7.2-8.0 (4H, aromatic).
49	δ: 1.00 (s, 6H, CH ₃), 3.65 and 3.75 (d of d, 2H, OCH ₂), 6.05 (s, 1H, pyrimidine H), 7.2-8.1 (4H, aromatic H).
54	δ: 2.9 (s, 3H, CH ₃ N), 3.10 (s, 3H, CH ₃ O), 3.90 (s, 6H aromatic OCH ₃), 6.10 (s, 1H, pyrimidine H), 7.2-7.9 (3H, aromatic H).
61	δ: 1.24 (s, 6H, CH ₃), 3.98 (s, 2H, CH ₂ O), 4.74 (s, 2H, CH ₂), 7.16 (s, 1H, pyrimidine H).
65	δ: 3.96 (s, 6H, OCH ₃), 5.96 (s, 1H, pyrimidine H), 6.32 (s, 1H, OCH), 7.27 (d, 1H, thienyl H), 7.85 (d, 1H, thienyl H).
66	δ: 4.08 (s, 6H, OCH ₃), 6.27 (s, 1H, OCH), 7.18 (d, 1H, thienyl H), 7.95 (d, 1H, thienyl H).
76	δ: 1.63 (t, 3H, CH ₂ CH ₃), 3.91 (s, 6H, OCH ₃), 4.1 (q, 2H, OCH ₂), 6.08 (s, 1H, pyrimidine H), 7.2-7.8 (m, 3H, aromatic H).
83	δ: 3.85 (s, 6H, OCH ₃), 4.52-4.63 (d, 2H, NCH ₂), 5.21-5.42 (s, 1H, OH), 5.80 (s, 1H, OCH), 6.82 (s, 1H, pyrimidine), 7.25 (s, 5H, aromatic), 7.31-7.52 (m, 1H, pyridine), 7.80-8.12 (d, 1H, pyridine), 8.35-8.55 (d, 1H, pyridine), 8.58-8.88 (s, 1H, NH).
84	δ: 3.85 (s, 6H, OCH ₃), 4.05 (t, 2H, NCH ₂), 5.0-5.45 (m, 3H, CH-CH ₂), 5.85 (s, 1H, pyrimidine), 6.80 (s, 1H, OCH), 7.2-8.6 (m, 3H, pyridine).
86	δ: 3.85 (s, OCH ₃), 5.37 (s, OCH ₂ Ar), 5.85 (s, pyrimidine), 6.80 (d, OCH), 7.2-8.2 (m, aromatic), mixt-

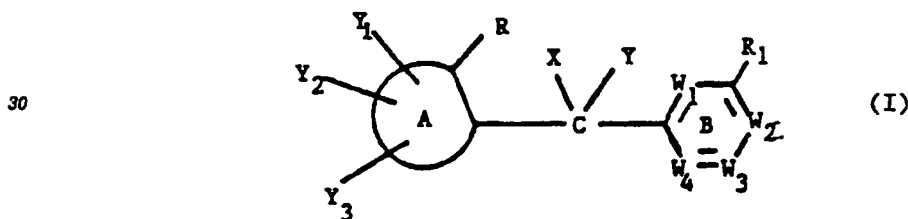
		ure with cpd. 40.
	88	δ : 4.00 (s, 3H, OCH ₃), 5.50 (s, 2H, OCH ₂), 6.05 (s, 1H, pyrimidine H), 6.27 (s, 1H, O-CH) 7.1-7.7 (m, 8H, aromatic H).
	95	δ : 3.85 (s, 6H, OCH ₃), 5.42 (s, 2H, OCH ₂), 6.05 (s, 1H, OCH), 6.42 (s, 1H, pyrimidine), 7.05-7.35 (s, 5H, aromatic), 7.35-7.768 (m, 11H, pyridine), 7.78-8.1 (d, 1H, pyridine), 8.81-9.01 (d, 1H, pyridine).
5	97	δ : 3.80 (s, 6H, OCH ₃), 5.35 (s, 2H, OCH ₂ Ar), 6.85 (s, 1H, pyrimidine), 6.65 (s, 1H, OCH), 7.15-8.6 (m, 8H, aromatic), mixture with cpd. 40.
	107	δ : 1.92 (s, 3H, C \equiv CCH ₃), 3.98 (s, 6H, OCH ₃), 4.92 (s, 2H, OCH ₂), 6.07 (s, 1H, OCH), 6.58 (s, 1H, pyrimidine), 7.52-7.88 (m, 1H, pyridine), 8.10-8.32 (d, 1H, pyridine), 8.90-8.91 (d, 1H, pyridine).
10	110	δ : 0.75-1.12 (t, 3H, CH ₃), 3.18-3.48 (m, 2H, CH ₂), 3.81 (s, 6H, OCH ₃), 4.42-4.91 (m, 3H, OH and NCH ₂), 5.82 (s, 1H, OCH), 6.72 (s, 1H, pyrimidine), 7.21-7.52 (m, 1H, pyridine), 7.82-8.08 (d, 1H, pyridine), 8.32-8.61 (d, 1H, pyridine).
	112	δ : 1.12-1.31 (d, 6H, CH ₃), 3.81 (s, 6H, OCH ₃), 4.12-4.32 (m, 1H, NCH), 5.85 (s, 1H, OCH), 6.71 (s, 1H, pyrimidine), 7.21-7.52 (q, 1H, pyridine), 7.81-8.09 (d, 1H, pyridine), 8.12-8.31 (m, 1H, NH), 8.39-8.55 (d, 1H, pyridine).
15	119	δ : 3.05 (d, 3H, NCH ₃), 3.94 (s, 6H, OCH ₃), 5.20 (s, 1H, OH), 5.75 (s, 1H, OCH), 5.98 (s, 1H pyrimidine H), 7.26 (d, 1H, pyridine H), 7.82 (q, 1H, NH), 8.28 (d, 1H, pyridine H).
	127	δ : 3.75 (s, 6H, OCH ₃), 4.05 (t, 2H, NCH ₂), 5.05-5.5 (m, 3H, CH=CH ₂), 5.85 (s, 1H, pyrimidine), 7.2-8.6 (m, 9H, aromatic + OCH).
20	128	δ : 2.20 (s, 3H, CH ₃), 3.75 (s, 6H, OCH ₃), 4.10 (t, 2H, NCH ₂), 5.0-6.6 (m, 3H, CH=CH ₂), 5.85 (s, 1H, pyrimidine), 7.2-8.6 (m, 5H, pyridine + NH, OCH).
	130	δ : 0.75-1.61 (m, 15H, aliphatic), 1.61-3.02 (m, 8H, aliphatic), 3.15-3.61 (m, 2H, NCH ₂), 3.81 (s, 6H, OCH ₃), 5.82 (s, 1H, OCH), 6.81 (s, 1H, pyrimidine), 7.21-7.52 (q, 1H, pyridine), 7.92-8.15 (d, 1H, pyridine), 8.17-8.32 (m, 1H, NH), 8.35-8.52 (d, 1H, pyridine).
25	133	δ : 2.85 (d, 3H, NCH ₃), 3.85 (s, 6H, OCH ₃), 4.10 (t, 2H, NCH ₂), 5.0-6.0 (m, 3H, CH=CH ₂), 5.85 (s, 1H, pyrimidine), 7.2-8.6 (m, 4H, pyridine + OCH).
	150	δ 0.96 (t, 3H, CH ₃), 1.68 (m, 2H, CH ₂ CH ₂ CH ₃), 3.50 (m, 2H, NCH ₂), 3.93 (s, 6H, OCH ₃), 5.92 (s, 1H, pyrimidine H), 6.17 (d, 1H, OCH), 7.21 (d of d, 1H, pyridine H), 8.07 (d of d, 1H, pyridine H), 8.57 (d of d, 1H, pyridine H), 8.66 (t, 1H, NH).
30	151	δ : 1.41-1.61 (d, 3H, CH ₃), 3.82 (s, 6H, OCH ₃), 4.92-5.35 (m, 2H, NCH, OH), 5.81 (s, 1H, OCH), 6.85 (s, 1H, pyrimidine), 7.12-7.51 (m, 6H, aromatic and pyridine), 7.82-8.10 (d, 1H, pyridine), 8.38-8.50 (d, 1H, pyridine) 8.51-8.82 (m, 1H, NH).
	152	δ : 2.25 (s, 3H, CH ₃), 3.89 (s, 6H, OCH ₃), 3.42-3.61 (d, 2H, NCH ₂), 5.81 (s, 1H, OCH), 6.85 (s, 1H, pyrimidine), 7.03 (s, 4H, aromatic), 7.12-7.52 (q, 1H, pyridine), 7.85-8.12 (d, 1H, pyridine), 8.40-8.51 (d, 1H, pyridine), 8.58-8.72 (m, 1H, NH).
35	171	δ : 1.24 (t, 3H, CH ₃), 2.60 (q, 2H, CH ₂), 3.86 (s, 6H, OCH ₃), 4.62 (d, 2H, NCH ₂), 5.86 (s, 1H, pyrimidine H), 6.90 (d, 1H, OCH), 7.0-8.54 (m, 7H, aromatic H), 8.60 (bs, 1H, NH).
	174	δ : 3.83 (s, 3H, OCH ₃), 3.90 (s, 6H, OCH ₃), 5.83 (s, 1H, pyrimidine H), 6.60 (d, 1H, OCH), 7.30 (d of d, 1H, pyridine H), 8.23 (d of d, 1H, pyridine H), 8.70 (d of d, 1H, pyridine H).
40	177	δ : 2.20 (s, 6H, CH ₃), 2.31-2.60 (m, 2H, CH ₂ N), 3.31-3.75 (q, 2H, NCH ₂), 3.78 (s, 6H, OCH ₃), 5.75 (s, 1H, OCH), 6.61 (s, 1H, pyrimidine), 7.13-7.42 (q, 1H, pyridine), 7.71-7.91 (d, 1H, pyridine), 8.31-8.51 (d, 1H, pyridine).
	178	δ : 3.85 (s, 9H, OCH ₃), 3.95 (s, 3H, OCH ₃), 4.14 (s, 2H, CH ₂), 5.82 (s, 1H, pyrimidine H), 6.90 (d, 1H, pyridine H), 8.12 (d, 1H, pyridine H).
45	187	δ : 3.70 (s, 9H, OCH ₃), 5.82 (s, 1H, pyrimidine H), 6.80 (d, 1H, pyridine H), 8.10 (d, 1H, pyridine H).
	193	δ : 0.85-1.05 (d, 6H, CH ₃), 3.85 (s, 6H, OCH ₃), 4.53-4.82 (q, 1H, CH), 5.25-5.55 (m, 2H, OH and NCH), 5.82 (s, 1H, OCH), 6.88 (s, 1H, pyrimidine), 7.25-7.51 (q, 1H, pyridine), 7.83-8.05 (d, 1H, pyridine), 8.41-8.60 (d, 1H, pyridine), 8.72-8.85 (d, 1H, NH).
	196	δ : 3.78 (s, 6H, OCH ₃), 4.51-4.78 (d, 2H, NCH ₂), 5.35 (s, 1H, OH), 5.81 (s, 1H, OCH), 6.28 (s, 2H, furfuryl), 6.81 (s, 1H, pyrimidine), 7.12-7.43 (m, 2H, furfuryl), 7.82-8.05 (d, 1H, pyridine), 8.31-8.43 (d, 1H, pyridine), 8.52-8.71 (m, 1H, NH).
50	201	δ : 1.87-2.04 (m, 4H, CH ₂ and tetrahydrofuran), 3.71-3.92 (m, 9H, OCH ₃ and tetrahydrofuran), 5.86-5.87 (m, 2H, OCH and OH), 6.71 (d, 1H, pyrimidine), 7.31-7.42 (d, 1H, pyridine), 7.81-7.92 (d, 1H, pyridine), 8.41-8.50 (d, 2H, NH and pyridine).
55	206	δ : 2.22 (s, 1H, CH ₃), 3.85 (s, 6H, OCH ₃), 3.92 (s, 3H, OCH ₃), 3.97 (s, 3H, OCH ₃), 5.86 (s, 1H, pyrimidine H), 6.80 (s, 1H, OCH), 7.10 (d, 1H, pyridine H), 8.16 (d, 1H, pyridine H).
	209	δ : 3.63-3.74 (t, 9H, OCH ₃), 5.48-5.81 (m, 4H, CHO, OH, COCH), 6.88-7.42 (m, 8H, phenyl, pyrimidine, pyridine), 7.94-7.97 (d, 1H, pyridine), 8.45-8.47 (d, 1H, pyridine) 9.24-9.26 (d, 1H, NH).

212	δ: 3.85 (s, 6H, OCH ₃), 4.41-4.52 (m, 2H, NCH ₂), 5.21-5.72 (d, s, 4H, NH ₂ , OCH, OH), 6.61 (s, 1H, pyrimidine), 7.12-7.32 (m, 3H, pyridine, benzyisulfon), 7.71-7.80 (m, 3H, pyridine, benzyisulfon), 8.3 (d, 1H, pyridine), 8.71 (m, 1H, NH).
213	δ: 3.61 (s, 6H, OCH ₃), 4.60-5.18 (m, 3H, ArCH ₂ , OH), 5.72 (s, 1H, OCH), 6.72 (s, 1H, pyrimidine), 7.15-7.17 (t, 5H, pyridine), 7.84-7.86 (d, 1H, pyridine), 8.38-8.44 (d, 2H, pyridine), 9.12 (s, 1H, NH).
5 214	δ: 3.75 (s, 6H, OCH ₃), 4.72-4.74 (d, 2H, NCH ₂), 5.84 (s, 1H, OCH), 6.86-6.96 (d, 3H, pyrimidine, thiophenyl), 7.14-7.16 (d, 1H, pyridine), 7.32-7.36 (d, 1H, pyridine), 7.94-7.97 (d, pyridine), 8.39-8.40 (d, 1H, pyridine), 8.71 (d, 1H, NH).
216	δ: 1.31 (t, 3H, CH ₃), 2.62 (s, 3H, CH ₃), 3.87 (s, 6H, OCH ₃), 4.21 (s, 2H, CH ₂), 4.40 (q, 2H, OCH ₂), 5.83 (s, 1H, pyrimidine H), 7.13 (d, 1H, pyridine H), 8.44 (d, 1H, pyridine H).
10 218	δ: 2.84 (3.08) (s, 3H, NCH ₃), 3.92 (s, 6H, OCH ₃), 4.50-5.03 (m, 2H, NCH ₂), 6.10 (s, 1H, pyrimidine H), 7.10-7.80 (m, 7H, aromatic H).
227	δ: 1.50 (m, 6H, CH ₂), 2.40 (m, 6H, NCH ₂), 3.55 (q, 2H, NCH ₂), 3.80 (s, 6H, OCH ₃), 5.85 (s, 1H, pyrimidine H), 6.70 (s, 1H, OCH), 7.15-8.60 (m, 1H, 3 pyridine H + NH).
15 233	δ: 1.80 (q, 2H, CH ₂), 2.25 (s, 6H, NCH ₃), 2.35 (q, 2H, NCH ₂), 3.45 (q, 2H, NCH ₂), 3.80 (s, 6H, CH ₃), 5.80 (s, 1H, pyrimidine), 6.65 (s, 1H, OCH), 7.15-8.50 (m, 3H, pyridine).
234	δ: 1.00 (t, 6H, CH ₃), 2.60 (m, 6H, NCH ₂), 3.50 (q, 2H, NCH ₂), 3.92 (s, 6H, OCH ₃), 5.80 (s, 1H, pyrimidine H), 6.80 (s, 1H, OCH), 7.15-8.7 (m, 3H, pyridine).
236	δ: 1.37 (t, 3H, CH ₃), 2.56 (s, 3H, CH ₃), 3.87 (s, 6H, OCH ₃), 4.43 (q, 2H, OCH ₂), 5.87 (s, 1H, pyrimidine H), 6.12 (s, 1H, CHBr), 7.90 (d, 1H, pyridine H), 8.56 (d, 1H, pyridine H).
20 237	δ: 1.40 (t, 3H, CH ₃), 3.87 (s, 6H, OCH ₃), 4.43 (q, 2H, OCH ₂), 4.70 (s, 2H, CH ₂ Br), 5.88 (s, 1H, pyrimidine H), 6.23 (s, 1H, CHBr), 8.07 (d, 1H, pyridine H), 8.65 (d, 1H, pyridine H).
238	δ: 1.37 (t, 3H, CH ₃), 2.06 (s, 3H, CH ₃), 3.88 (s, 6H, OCH ₃), 4.40 (q, 2H, OCH ₂), 5.28 (s, 2H, OCH ₂), 5.87 (s, 1H, pyrimidine H), 6.23 (s, 1H, CHBr), 8.04 (d, 1H, pyridine H), 8.64 (d, 1H, pyridine H).
25 257	δ: 3.82 (s, 6H, OCH ₃), 4.06 (s, 2H, NCH ₂), 5.05-5.10 (s, 1H, OH), 5.42-5.45 (s, 1H, NH), 5.87 (s, 1H, OCH), 6.76-6.86 (s, 1H, pyrimidine), 7.32-7.38 (m, 6H, pyridine, aromatic), 7.94-7.98 (d, pyridine), 8.45-8.49 (d, 1H, pyridine), 9.55 (s, 1H, NH).
264	δ: 0.8-1.9 (br s, 25H, aliphatic), 3.85-3.90 (s, 6H, 2XOMe), 6.15 (s, 1H, ArH, pyrimidine), 7.4 (s, 2H, ArH).
30 277	δ: 0.90 (t, 3H, CH ₃), 1.2-1.7 (m, 4H, aliphatic), 3.95 (s, 6H, OCH ₃), 4.08 (t, 2H, OCH ₂), 6.15 (s, 1H, pyrimidine H), 7.5-7.7 (m, 3H, aromatic).
281	δ: 0.90 (t, 3H, CH ₃), 1.3 (m, 4H, aliphatic), 1.6 (m, 2H, aliphatic), 3.95 (s, 6H, OCH ₃), 4.08 (t, 2H, OCH ₂), 6.15 (s, 1H, pyrimidine H), 7.4-7.7 (m, 3H, aromatic).
283	δ: 3.40 (s, 6H, OCH ₃), 3.43 (m, 2H, NCH ₂), 3.82 (s, 6H, OCH ₃), 4.47 (t, 1H, CH), 5.86 (s, 2H, OCH, OH), 6.77 (s, 1H, pyrimidine), 7.41-7.43 (m, 1H, pyridine), 7.94-7.98 (d, 1H, pyridine), 8.47-8.48 (d, 1H, NH).
35 284	δ: 1.71-1.76 (s, 6H, CH ₃), 2.31 (s, 1H, C≡CH), 3.82 (s, 6H, OCH ₃), 5.61-5.63 (d, 1H, OH), 5.85 (s, 1H, OCH), 6.86-6.96 (d, 1H, pyrimidine), 7.44-7.48 (m, 1H, pyridine), 7.94-7.98 (d, 1H, pyridine), 8.44-8.45 (d, 2H, NH).
40 285	δ: 0.75-1.13 (m, 4H, aliphatic), 1.28-1.77 (m, 3H, aliphatic), 3.23-3.52 (m, 2H, NCH ₂), 3.82 (s, 6H, OCH ₃), 5.73-5.88 (m, 2H, OH, OCH), 6.60-6.81 (d, 1H, pyrimidine), 7.21-7.45 (q, 1H, pyridine), 7.78-8.01 (d, 1H, pyridine), 8.32-8.55 (d, 2H, pyridine, NH).
286	δ: 1.21-1.32 (d, 2H, CH ₂ O), 3.38-3.58 (d, 6H, CH ₃), 3.85 (s, 6H, OCH ₃), 4.18-4.48 (m, 2H, NCH, OH), 5.88 (s, 1H, OCH), 6.73 (s, 1H, pyrimidine), 7.28-7.52 (q, 1H, pyridine), 7.81-8.08 (d, 1H, pyridine), 8.43-8.62 (d, 2H, pyridine, NH).
45 290	δ: 3.74 (s, 9H, OCH ₃), 5.44 (bs, 1H, OH), 5.73 (s, 1H, pyrimidine), 6.62 (bs, 1H, OCH), 6.9-8.6 (m, aromatic, 7H), 10.22 (s, 1H, NH).
291	δ: 1.40 (m, 8H, CH ₂), 2.28 (s, 6H, NCH ₃), 2.68 (m, 2H, NCH ₂), 3.40 (m, 2H, NCH ₂), 3.80 (s, 6H, OCH ₃), 5.80 (s, 1H, pyrimidine), 6.70 (s, 1H, OCH), 7.2-8.6 (m, 4H, pyridine H + OH).
50 292	δ: 1.60 (m, 4H, CH ₂), 2.25 (s, 6H, NCH ₃), 2.25 (m, 2H, NCH ₂), 3.48 (m, 2H, NCH ₂), 3.65 (s, 6H, OCH ₃), 5.80 (s, 1H, pyrimidine), 6.65 (s, 1H, OCH), 7.2-8.6 (m, 4H, pyridine + OH).
295	δ: 3.74 (s, 6H, OCH ₃), 3.80 (s, 6H, OCH ₃), 4.50 (d, 2H, NCH ₂), 5.84 (s, 1H, pyrimidine), 6.5-8.6 (m, 8H, aromatic, OCH, NH).
297	δ: 3.65 (s, 6H, OCH ₃), 3.77 (s, 6H, OCH ₃), 4.50 (d, 2H, NCH ₂), 5.64 (d, 1H, OH), 5.80 (s, 1H, pyrimidine), 6.25-6.60 (m, 3H, aromatic), 6.8 (d, 1H, OCH), 7.2-8.6 (m, 3H, pyridine).
55 298	δ: 3.82 (s, 6H, OCH ₃), 5.81 (s, 1H, OCH), 6.29-7.58 (m, 8H, OH, NH, pyrimidine, aromatic, pyridine), 7.80-8.25 (d, 1H, pyridine), 8.48-8.62 (d, 1H, pyridine), 9.74-9.93 (br, 1H, NH).
299	δ: 0.85 (t, 3H, CH ₃), 1.2 (m, 8H, aliphatic), 1.6 (m, 2H, aliphatic), 3.95 (s, 6H, OCH ₃), 4.08 (t, 2H,

- OCH₂), 6.15 (s, 1H, pyrimidine H), 7.4-7.7 (m, 3H, aromatic).
- 300 δ : 0.90 (t, 3H, CH₃), 1.2 (m, 10H, aliphatic), 1.6 (m, 2H, aliphatic), 3.95 (s, 6H, OCH₃), 4.08 (t, 2H, OCH₂), 4.08 (t, 2H, OCH₂), 6.15 (s, 1H, pyrimidine H), 7.4-7.7 (m, 3H, aromatic).
- 303 δ : 3.80 (s, 6H, OCH₃), 3.90 (d, 6H, OCH₃), 5.45 (d, 1H, OH), 5.80 (s, 1H, pyrimidine), 6.85 (s, 1H, OCH), 7.0-8.6 (m, 6H, aromatic), 10.2 (s, 1H, NH).
- 5 305L(-) δ : 1.60 (d, 3H, CH₃), 3.75 (2s, 6H, OCH₃), 5.25 (m, 1H, OH), 5.75 (s, 1H, pyrimidine), 6.75 (d, 1H, OCH), 7.2-8.6 (m, 8H, aromatic).
- 308 δ : 0.88 (t, 3H, CH₃), 1.25 (bs, 18H, aliphatic), 1.6 (m, 2H, aliphatic), 3.95 (s, 6H, OCH₃), 4.07 (t, 2H, O-CH₂), 6.15 (s, 1H, pyrimidine H), 7.55-7.7 (m, 3H, aromatic).
- 10 330 δ : 1.05 (m, 6H, NCH₂CH₃), 1.27 (s, 9H, C(CH₃)₂), 2.3 (m, 4H, NCH₂), 3.8 (s, 6H, OCH₃), 5.8 (s, 1H, pyrimidine H), 5.9 (s, 1H, CH-Ot-Bu), 7.18 (d of d, 1H, pyridine H), 7.45 (d of d, 1H, pyridine H), 8.6 (d of d, 1H, pyridine H).
- 407 δ : 3.18 (m, 2H, CH₂S), 3.65 (m, 2H, CH₂N), 3.95 (s, 6H, OCH₃), 5.85 (s, 1H, pyrimidine), 6.80 (s, 1H, OCH), 7.0-8.7 (m, 8H, aromatic).
- 15 411 δ : 1.90 (t, 3H, CH₃), 1.55 (m, 4H, CH₂), 2.65 (m, 4H, CH₂S), 3.62 (m, 2H, CH₂N), 3.82 (s, 6H, CH₃O), 5.90 (s, 1H, pyrimidine), 6.75 (s, OCH), 7.2-8.65 (m, 3H, pyridine).
- 412 δ : 1.37 (s, 9H, tBuO), 3.30 (s, 3H, CH₃N), 3.90 (s, 6H, CH₃), 5.95 (s, 1H, pyrimidine), 5.97 (s, 1H, OCH), 6.5-7.6 (m, 10H, aromatic).
- 413 δ : 2.23 (s, 1H, C=CH), 3.12-3.23 (d, 3H, N-CH₃), 3.93 (s, 8H, OCH₃, N-CH₂C≡), 6.155 (s, 1H, pyrimidine), 7.47-7.52 (m, 1H, pyridine), 8.142-8.168 (m, 1H, pyridine), 8.69-8.709 (t, 1H, pyridine).
- 20

Claims

- 25 1. A compound of formula I



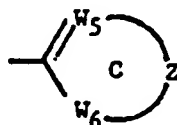
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wherein

ring A is selected from

- a) phenyl or naphthyl
 b) pyridyl which may be fused by its (b) or (c) side to benzene
 40 c) pyridyl-N-oxide or pyrazinyl-N-oxide
 d) pyrimidinyl
 e) pyrazinyl
 f) 3- or 4-cinnolynyl or 2-quinoxalynyl, and
 g) a five membered heteroaromatic ring comprising oxygen, sulphur or nitrogen as heteroatom(s)
 45 which ring may be fused to a benzene ring or may comprise nitrogen as an additional heteroatom;
 R is cyano, formyl, CX₁X₂X₃, a ketone forming group, a carboxyl group which may be in the form of the free acid or in ester or salt form, a thiole group which may be in the form of the free acid or in ester form, a carbamoyl group or a mono- or di- substituted carbamoyl group, hydroxyC₁₋₈alkyl, hydroxybenzyl, -CH=NOM, -CH=NOC₁₋₈alkyl, the group -CH₂-O-C(O)- and bridges adjacent carbon atoms
 50 in ring A, or a ring C

55

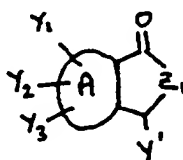


Y₁, Y₂ and Y₃ are attached to carbon atoms and are independently hydrogen, halogen, hydroxy, C₁₋₈-alkyl, C₂₋₈alkenyl, C₂₋₈alkynyl, C₁₋₈alkoxy, C₂₋₈alkenyloxy, C₂₋₈alkynyloxy, C₁₋₈alkylsulfonyloxy, di(C₁₋₈alkyl)sulfamoyloxy, C₁₋₈alkylsulfonyl, C₁₋₈alkylsulfinyl, di(C₁₋₈alkyl)carbamoyloxy, C₁₋₈alkylthio, C₂₋₈alkenylthio or C₂₋₈alkynylthio each of which may in turn be substituted by 1 to 6 halogen atoms; di(C₁₋₈alkoxy)methyl, conjugated C₁₋₈alkoxy, hydroxyC₁₋₈alkyl, carboxyl, C₂₋₈acyl, C₂₋₈acylC₁₋₈alkyl, C₂₋₈acyloxy, C₂₋₈acyloxyC₁₋₈alkyl, tri(C₁₋₈alkyl)silyloxy, tri(C₁₋₈alkyl)silyl, cyano, nitro, amino or substituted amino, aminosulfonyl; C₃₋₈cycloalkyl, aryl, arylC₁₋₈alkyl, arylC₂₋₈alkenyl, arylC₂₋₈alkynyl, C₁₋₈aryloxy, arylC₁₋₈alkoxy, arylsulfonyl, arylsulfinyl, arylthio or arylC₁₋₈alkylthio, each of which may be substituted by one to three substituents selected from halogen, C₁₋₈alkyl, C₁₋₈haloalkyl, C₁₋₈alkoxy, C₁₋₈haloalkoxy, nitro, cyano, C₁₋₈alkylthio, C₂₋₈acyl, amino or substituted amino; a group -C(O)-R' wherein R' is hydrogen, C₁₋₈alkyl, or C₁₋₈alkoxy; or
 Y₁ and R taken together on adjacent carbon atoms form a bridge having the formula -C(S)-O-, -C(O)-O-E- or -C(O)-N(R₂)-E- wherein E is a direct bond or a 1 to 3 membered linking group with elements selected from methylene, substituted methylene, -N(R₂)- and oxygen; or
 Y₁ and Y₂ taken together on adjacent carbon atoms form a 3- to 5-membered bridge comprised of elements selected from methylene, substituted methylene, -CH=, -C(R₄)=, -NH-, oxygen and -S(O)n-; each of W₁, W₂, W₃, W₄ and W₅ is independently CH, CR₃ or nitrogen; W₆ is NH, oxygen, sulfur, -CR₄=, -CH= or -C(O)-;
 Z is a 2- or 3-membered bridge comprised of elements selected from methylene, substituted methylene, -CH=, -C(R₄)=, -C(O)-, -NH-, -N=, oxygen and -S(O)n-;
 R₁ and R₃ each is independently hydrogen, halogen, C₁₋₈alkyl, C₂₋₈alkenyl, C₂₋₈alkynyl, C₁₋₈alkoxy, C₂₋₈alkenyloxy, C₂₋₈alkynyloxy, C₁₋₈alkylthio, C₂₋₈alkenylthio or C₂₋₈alkynylthio, each of which may in turn be substituted by 1 to 6 halogen atoms; C₃₋₈cycloalkyl, a 5- or 6-membered heterocycloC₁₋₈alkoxy, aryl, arylC₁₋₈alkoxy or arylC₁₋₈alkylthio each of which may be substituted by 1 to 3 substituents selected from halogen, C₁₋₈alkyl, C₁₋₈haloalkyl, C₁₋₈alkoxy, C₁₋₈haloalkoxy, nitro, cyano, C₁₋₈alkylthio, C₂₋₈acyl, amino or substituted amino; aminoxy, substituted aminoxy; iminoxy; substituted iminoxy; amido; substituted amido; C₁₋₈alkylsulfonylethyl; cyano; nitro; or -C(O)-Y₄, wherein Y₄ is hydrogen, C₁₋₈alkyl, C₁₋₈alkoxy, hydroxy or unsubstituted or substituted phenyl;
 R₂ is hydrogen, C₁₋₈alkyl, C₁₋₈haloalkyl, C₁₋₈alkoxyalkyl, C₁₋₈alkoxy, arylC₁₋₈alkoxy, unsubstituted or substituted aryl, unsubstituted or substituted arylC₁₋₈alkyl;
 R₄ is as defined for Y₁ except for hydrogen;
 X and Y each is independently hydrogen, hydroxy, halogen, cyano, C₁₋₈alkyl, C₁₋₈alkoxy, C₁₋₈alkoxycarbonyl, C₁₋₈alkoxycarbonyloxy, hydroxyC₁₋₈alkyl, C₁₋₈haloalkyl, C₂₋₈acyl, C₂₋₈acyloxy, carbamoyl, carbamoyloxy, C₁₋₈alkylthio, C₁₋₈alkylsulfinyl, C₁₋₈alkylsulfonyl or C₁₋₈alkylsulfonyloxy; aryl, aryl, aryl, arylS(O)_p, arylC₁₋₈alkyl, arylC₁₋₈alkoxy, arylC₁₋₈alkylS(O)_p, arylsulphonyloxy, each of which may in turn be substituted by 1 to 3 substituents selected from halogen, C₁₋₈alkyl, C₁₋₈haloalkyl, C₁₋₈alkoxy, C₁₋₈haloalkoxy, nitro, cyano, C₁₋₈alkylthio, C₂₋₈acyl; amino, substituted amino or together represent =O, =S, =NH, =NOR₁₂ or =CR₁₃R₁₄; or
 X and R together may form a bridge having the formula -C(O)-O-, -C(O)-S or -C(O)-NR₂- wherein the carbonyl is attached to A;
 P is 0, 1 or 2;
 X₁, X₂ and X₃ are independently hydrogen, hydroxy, C₁₋₈alkoxy, C₁₋₈alkylthio, hydroxyC₁₋₈alkyl or hydroxybenzyl whereby at least one of X₁, X₂ and X₃ is other than hydrogen; or
 X₃ is hydrogen and X₁ and X₂ together form a 4- or 5-membered bridge comprising elements selected from -O(CH₂)_m-, -O-, -OC(O)(CH₂)_mO- and -S(CH₂)_mS-;
 R₁₂ is hydrogen or C₁₋₈alkyl;
 R₁₃ and R₁₄, are independently hydrogen, C₁₋₈alkyl or halogen;
 m is 1 or 2;
 n is 0, 1 or 2; and
 n' is 2 or 3;
 with the proviso that when R is carboxyl in free ester or salt form and X and Y together are =O one of rings A and B contains a hetero atom.

2. A compound of formula (I) according to Claim 1 wherein
 R is a carboxyl group which may be in the form of the free acid or in ester or salt form, a carbamoyl

group or a mono- or di-substituted carbamoyl group; or
 X and R together form a bridge having the formula $-C(O)-O-$, wherein the carbonyl is attached to A; and
 Y₁, Y₂ and Y₃ are attached to carbon atoms and are independently hydrogen, C₁₋₆alkyl, C₁₋₆alkoxy, halo-
 gen, C₁₋₆alkylthio, arylthio or arylC₁₋₆alkoxy whereby the aryl is optionally substituted by a halogen, C₂₋₆-
 alkenyloxy or C₂₋₆alkynyloxy.

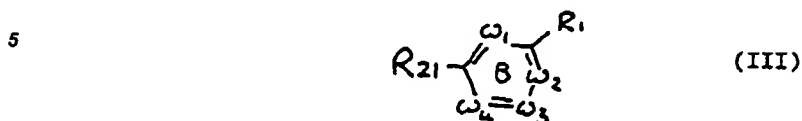
3. A compound of formula (I) according to Claims 1 to 2 wherein
 X and Y each is independently hydrogen, hydroxy, cyano, C₁₋₆alkoxy, C₂₋₆acyloxy, halogen, C₁₋₆alkyl-
 thio, C₁₋₄alkoxycarbonyloxy, aryl or arylthio optionally substituted by one or more halogen, C₁₋₄alkoxy
 or C₁₋₄haloalkoxy or together =O or =NH; and
 R₁ and R₃ each is independently halogen, C₁₋₆alkoxy, C₁₋₆alkyl, C₁₋₆haloalkyl, C₁₋₆haloalkoxy, aryloxy
 or arylC₁₋₆alkoxy whereby the aryl is optionally substituted by halogen or C₁₋₄alkyl, C₂₋₆alkynyloxy or
 C₂₋₆alkenyloxy.
4. A compound of formula (I) according to Claims 1 to 3 wherein A is pyridyl, phenyl, pyridyl-N-oxide or thienyl.
5. A compound of formula (I) according to Claims 1-4 wherein
 W₁ and W₄ are N;
 W₂ is N or CH; and
 W₃ is CR₃.
6. A compound of formula (I) according to Claim 1 wherein
 ring A is phenyl or pyridyl;
 R is a carboxyl group in the form of a free acid or salt; carbamoyl; COOR₅ wherein R₅ is C₁₋₅alkyl or
 C₂₋₆alkenyl; or CONR₇R₈ wherein
 R₇ is C₁₋₁₂alkyl, amino, C₁₋₄alkylamino, anilino, haloanilino, benzyl, halobenzyl, C₁₋₄alkylbenzyl,
 C₁₋₄alkoxybenzyl, phenyl halophenyl, C₁₋₄alkylphenyl or C₁₋₄alkoxyphenyl;
 R₈ is hydrogen or C₁₋₄alkyl;
 Y₁, Y₂ and Y₃ are independently hydrogen or halogen
 W₁ and W₄ are N;
 W₂ is CH;
 W₃ is CR₃ wherein R₃ is C₁₋₅alkoxy;
 R₁ is C₁₋₆alkoxy;
 X is hydroxyl or C₁₋₄alkoxycarbonyloxy or taken with Y is =O;
 Y is hydrogen or taken with Y is =O; or
 X and R together form a bridge having the formula $-C(O)O-$ wherein the carbonyl is attached to A, and
 Y is hydrogen or C₂₋₆acyloxy.
7. A herbicidal composition comprising an herbicidally effective amount of a compound of formula (I) accord-
 ing to Claims 1-6.
8. A method for combatting weeds which comprises applying thereto or to a locus thereof an herbicidally
 effective amount of a compound of formula (I) according to Claims 1-6.
9. A process for preparing a compound of formula (I) according to Claim 1 comprising
 a) when X and R combine to form a bridging group as defined in claim 1 and Y is hydrogen, cyano,
 arylthio, arylsulfinyl or arylsulfonyl, reacting a compound of formula II



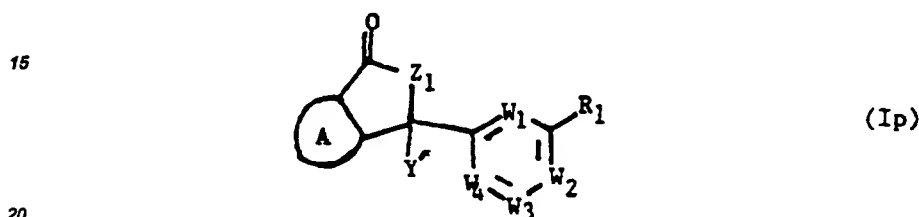
(II)

wherein ring A, Y₁, Y₂ and Y₃ are as defined in claim 1, Y' represents hydrogen, cyano, arylthio, aryl-

sulfinyl or arylsulfonyl and Z_1 represents oxygen, sulfur or NR_2 wherein R_2 is as defined in claim 1 with a compound of formula III



10 wherein W_1, W_2, W_3, W_4 and R_1 are as defined in claim 1 and R_{21} represents methylsulfonyl or halogen to obtain the corresponding compound of formula Ip



b) treating a compound of formula Ip wherein Y' represents cyano or arylsulfonyl and Z_1 represents oxygen and the other symbols are as defined in claim 1;

25 (i) by hydrolysis to give a corresponding compound of formula I wherein R and X form a bridge and Y is hydroxy or a compound of formula I wherein X and Y together form =O;

(ii) with an amino to give a corresponding compound of formula I wherein R is an optionally substituted carbamoyl group and X and Y together form =O;

(iii) with a group



30 wherein M is an alkali metal and R_{22} is hydrogen or C_{1-8} alkyl, to give a corresponding compound wherein R and X form a bridge and Y is hydroxy or C_{1-8} alkoxy;

c) hydrolyzing a compound of formula Ip wherein Y' represents hydrogen, Z_1 represents oxygen and the other symbols are as defined in claim 1 to give a compound of formula I wherein R is a carboxyl group optionally in salt form, X is hydrogen and Y is hydroxy;

35 d) ring opening a compound of formula Ip wherein Y' represents hydroxy, Z_1 represents oxygen and the other symbols are as defined in claim 1 to give a compound of formula I wherein R is a carboxyl group optionally in salt form and X and Y together are =O

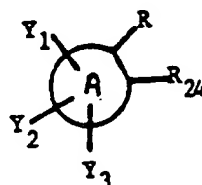
e) esterifying a compound of formula I wherein R is a carboxyl group optionally in salt form and X and Y are =O and the other symbols are as defined in claim 1 to give the corresponding compound wherein R is a carboxyl group in ester form;

40 f) halogenating a compound of formula Ip wherein Y' represents hydroxy, Z_1 is as defined in part a) and the other symbols are as defined in claim 1 to give a compound of formula I wherein X and R together form a bridging group and Y' is halogen;

45 g) reacting a compound of formula Ip wherein Z_1 is oxygen, Y' is halogen and the other symbols are as defined in claim 1 with a group R_2NH_2 and a group HOR_{23} wherein R_{23} represents C_{1-8} alkyl, C_{2-8} acyl or aryl and R_2 is as defined in claim 1 to give the corresponding compound wherein Z_1 is NR_2 and Y' is C_{1-8} alkoxy, aryloxy or C_{2-8} acyloxy;

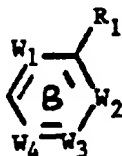
50 h) oxidizing a compound of formula Ip wherein Y' represents hydrogen, Z_1 is as defined in part a) and the other symbols are as defined in claim 1 to give the corresponding compound wherein Y' represents hydroxy;

i) reacting a compound of formula IV



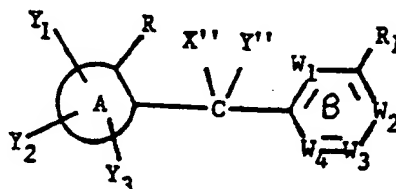
(IV)

with a compound of formula V



(V)

to produce a compound of formula Iq



(Iq)

wherein ring A, R, R₁, W₁, W₂, W₃, W₄, Y₁, Y₂ and Y₃ are as defined in claim 1 and X'' and Y'' are hydrogen and R₂₄ is C₁₋₈alkyl,

j) mono- or di-halogenating a compound of formula Iq wherein X'' and Y'' are hydrogen and the other symbols are as defined in part i) to produce the corresponding compound of formula Iq wherein one or both of X'' and Y'' are halogen;

k) oxidizing a compound of formula Iq wherein X'' and Y'' are both hydrogen or X'' is halogen and Y'' is hydrogen and the other symbols are as defined in claim 1 to produce the corresponding compound wherein X'' and Y'' together represent =O or one represents hydrogen and the other represents hydroxy;

l) alkylating a compound of formula Iq wherein X'' represents hydrogen and Y'' represents hydrogen and the other symbols are as defined in claim 1 to produce the corresponding compound wherein X'' represents C₁₋₈alkyl and Y'' represents hydrogen;

m) introducing a C₁₋₈alkoxy or C₁₋₈alkylthio group into a compound of formula Iq wherein X'' represents halogen, Y'' represents hydrogen and the other symbols are as defined in claim 1 to produce the corresponding compound wherein X'' represents C₁₋₈alkoxy or C₁₋₈alkylthio and Y'' represents hydrogen;

n) acylating a compound of formula Iq wherein X'' represents hydroxy, Y'' represents hydrogen and the other symbols are as defined in claim 1 to produce the corresponding compound wherein X'' represents acyloxy and Y'' represents hydrogen;

o) reacting a compound of formula Ip wherein Z₁ is oxygen, Y' is hydrogen and the other symbols are as defined in claim 1 with a group R₇NH₂ wherein R₇ is (a) hydrogen, halogen; (b) alkyl, alkenyl, alkynyl, alkoxy, alkoxyalkoxy, alkenyloxy, alkynyloxy, alkylS(O)_p, alkenylS(O)_p or alkynylS(O)_p, alkylS(O)_palkyl, alkenylS(O)_palkyl, alkynylS(O)_palkyl, each of which may in turn be substituted by 1 to 6 halogen atoms and each of which may be attached to the adjacent nitrogen atom via alkyl; (c) acyl, acylalkyl, acyloxy, acyloxyalkyl; (d) cycloalkyl, cycloalkylalkyl, heterocyclyl, heterocycloalkyl, heterocycloalkoxy, aryl, aralkyl, aryloxy, aralkoxy, arylS(O)_p, aralkylS(O)_p or arylS(O)_palkyl, each of which is unsubstituted or may be substituted by 1 to 3 substituents selected from (i) halogen; (ii) alkyl, alkenyl, alkynyl, alkoxy, alkoxyalkoxy, alkenyloxy, alkynyloxy, alkylS(O)_p, alkenylS(O)_p, or alkynylS(O)_p, alkylS(O)_palkyl, alkenylS(O)_palkyl or alkynylS(O)_palkyl, each of which may in turn be substituted by 1 to 6 halogen atoms; and (iii) nitro, cyano, acyl, amino, substituted amino, aminosulfonyl, aminoalkyl or substituted aminoalkyl; (e) amino, substituted amino, amido, substituted amido, aminosulfonyl, cyano, nitro, or -(CHR₄)_n-C(O)Y₄', wherein Y₄' is hydrogen, lower alkyl, lower alkoxy or hydroxy and n'' is 0, 1, 2 or 3 and p is 0,

1 or 2 and R_4' is as defined for Y_1 ; to give a compound of formula I wherein R is monosubstituted carbamoyl, X is hydrogen and Y is hydroxy;

p) sulfonylating, carbamoylating, acylating or carbalkoxylating a compound of formula Ip wherein Z_1 is oxygen, Y' is hydroxy and the other symbols are as defined in claim 1 to produce the corresponding compound of formula I wherein R and X form a $-C(O)-O-$ bridge and Y represents sulfonyloxy, carbamoyloxy, C_{2-8} acyloxy or C_{1-8} alkoxycarbonyloxy;

q) reacting a compound of formula Ip wherein Z_1 is oxygen, Y' is halogen and the other symbols are as defined in claim 1 with a group R_7R_8NH wherein R_7 is as defined in part o) and R_8 is as defined for R_7 to give a compound of formula I wherein R is disubstituted carbamoyl, and X and Z together represent $=O$;

and recovering any compound wherein R is a carboxyl or thiocarboxyl group in free form or in ester form and any compound wherein R is carboxyl in free form or in salt form.